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TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 75.

BERKSHIRE MEETING.

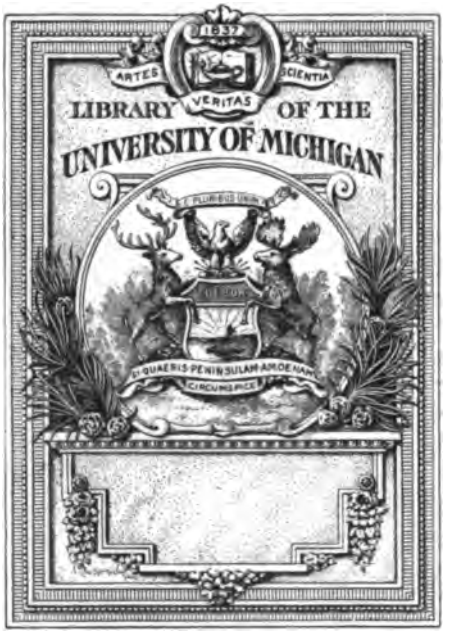
SEMI-ANNUAL MEETING.

HELD AT HOTEL ASPINWALL, LENOX, MASS.

SEPTEMBER 29 — OCTOBER 1, 1903.

Office of the Association:
Room 57, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF R. L. BARRY.
1903



THE GIFT OF
Association

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1550
.N2

NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

.....

Application Received

.....190 .

Action by Board of Government,.....favorable.

.....190 .

Voted by the Association,.....elected.

.....190 .

New England Cotton Manufacturers' Association.

Room 57, International Trust Building,

45 MILK STREET,

BOSTON, MASS.

PROPOSAL FOR MEMBERSHIP.

(When filled out, to be mailed to the Secretary, P. O. Box 3672, Boston, Mass., in time for action by the Board of Government, at least one week before a meeting of the Association.)

Mr. .....

Position, ...

P. O. Address, ...

is proposed for ..... *membership in the* NEW ENGLAND COTTON
active or associate

MANUFACTURERS' ASSOCIATION *by* .....
signature of member proposing candidate.

a member of the Association.

Experience of Applicant, (Please state, in full, particulars of detail, giving names, dates, and nature of work, as fully as convenient.)

.....

.....

.....

.....

.....

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.....

The undersigned certifies that the above statements are correct, and agrees that, if elected to the Association, he will be governed by its rules as long as his connection with it shall continue.

Date, ... 190 .

.....
signature of candidate.

Herbert C. Palmer

VI

TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 75.

BERKSHIRE MEETING.

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Room 57, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF E. L. BARRY,
1903

ENTERED ACCORDING TO ACT OF CONGRESS
IN THE YEAR 1903
BY THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,
IN THE OFFICE OF THE LIBRARIAN OF CONGRESS
AT WASHINGTON.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 61, is 50 cents to members but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,
Secretary of the Commonwealth.

197075

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

AMENDMENT TO CONSTITUTION AND BY-LAWS.

The following amendment was adopted at the seventy-fifth meeting of the Association, September 30, 1903:

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

All articles of the Constitution and By-Laws, beginning with Article 5, shall be increased in number to the next cardinal number."

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED APRIL 20, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars.* Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

* This assessment has never exceeded five dollars for active members and ten dollars for associate members.

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

LIFE MEMBERS.

ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

ARTICLE 6. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 7. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 8. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 9. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 10. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 11. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 12. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 13. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 14. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 15. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 16. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1903.

PRESIDENT.

HERBERT E. WALMSLEY, . . . New Bedford, Mass.

VICE-PRESIDENTS.

WILLIAM D. HARTSHORNE, . . Lawrence, Mass.
JAMES R. MacCOLL, ... Pawtucket, R. I.

DIRECTORS.

GEORGE P. GRANT, Jr., . . . Fitchburg, Mass.
PHILIP A. MATHEWSON, . . . Fall River, Mass.
J. R. MONTGOMERY, ... Windsor Locks, Conn
WILLIAM D. PENNELL, ... Lewiston, Me.
W. B. SMITH WHALEY, ... Columbia, S. C.
GEORGE F. WHITTEN, . . . Manchester, N. H.

AUDITOR.

C. E. ROBERTS, ... Boston, Mass.

SECRETARY AND TREASURER.

C. J. H. WOODBURY, P. O. Box 3672, Boston, Mass.

OFFICE OF THE ASSOCIATION:

Room 57, International Trust Building, 45 Milk Street, Corner of Devonshire Street, Boston, Mass.

OFFICERS OF THE ASSOCIATION,

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Edw. W. Thomas,	1894–95
Amos D. Lockwood,	1878–80	A. M. Goodale,	1895–96
John Kilburn,	1880–83	Arthur H. Lowe,	1896–97
William C. Lovering,	1883–85	Russell W. Eaton,	1897–98
Richard Garsed,	1885–86	Stephen A. Knight,	1898–99
J. S. Ludlam,	1886–88	Frederick E. Clarke,	1899–99
Henry F. Lippitt,	1888–89	D. M. Thompson,	1900–01
Walter E. Parker,	1889–92	Charles H. Fish,	1901–03
Robert McArthur,	1892–94	H. E. WALMSLEY,	1903–

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Simeon B. Chase,	1891–93
William A. Burke,	1865–73	E. W. Thomas,	1892–94
John C. Palfrey,	1873–76	A. M. Goodale,	1893-95
Edward Atkinson,	1876–78	William J. Kent,	1894–97
A. G. Cumnock,	1877–80	Fred. C. McDuffie,	1895–00
Charles Nourse,	1878–81	Henry T. Whitin,	1897–00
William F. Goulding,	1880–83	C. H. Richardson,	1900–01
Richard Garsed,	1881–85	George H. Hills,	1900–02
J. S. Ludlam,	1883–86	H. E. Walmsley,	1901–03
Walter E. Parker,	1885–89	Alfred E. Adams,	1902–03
Richard B. Borden,	1886–88	JAMES R. MacCALL,	1903–
Arnold B. Sanford,	1888–91	W. D. HARTSHORNE,	1903–
Robert McArthur,	1889–92		

DIRECTORS.

J. S. Davis,	1865–69	S. S. Spencer,	1887–90
Charles Nourse,	1865–78	E. W. Thomas,	1888–92
Phineas Adams,	1865–74	William W. Whitin,	1888–93
William P. Haines,	1865–69	Robert R. Smith,	1889–92
Thomas J. Borden,	1865–78	Alfred M. Goodale,	1890–93
Daniel D. Crombie,	1865–68	William J. Kent,	1891–94
A. M. Wade,	1868–69	Herman F. Straw,	1891–93
D. J. Johnston,	1869–70	Fred C. McDuffie,	1892–95
F. E. Clarke,	1869–75	George W. Bean,	1892–95
A. G. Cumnock,	1869–77	F. M. Messenger,	1893–95
Cyrus I. Barker,	1875–80	Albert F. Knight,	1893–99
Hervey Kent,	1877–81	Arthur H. Lowe,	1894–96
David J. Johnston,	1878–82	Henry T. Whitin,	1894–97
Walter Paine, 3d,	1878–80	Herbert L. Pratt,	1895–98
Chas. L. Lovering,	1878–83	Stephen A. Knight,	1895–98
Richard Garsed,	1880–81	John Eccles,	1895–99
William H. Jennings,	1880–83	Russell W. Eaton,	1896–97
Chas. D. McDuffie,	1881–83	C. H. Richardson,	1897–00
Walter E. Parker,	1881–85	George H. Hills,	1897–00
John W. Danielson,	1881–85	John T. Meats,	1898–01
William E. Barrows,	1882–83	Alfred E. Adams,	1899–02
Rufus A. Maxfield,	1883–86	A. Tenny White,	1899–02
George W. Weeks,	1883–86	Charles H. Fish,	1900–01
Henry S. Howe,	1883–87	Herbert E. Walmsley,	1900–01
Richard B. Borden,	1883–86	Wm. D. Hartshorne,	1901–03
O. S. Brown,	1885–91	James R. MacColl,	1901–03
Henry F. Lippitt,	1885–88	GEO. F. WHITTEN,	1898–
Wilbur A. Stiles,	1886–88	W. B. SMITH WHALEY,	1901–
Robert McArthur,	1886–89	J. R. MONTGOMERY,	1902–
Stephen N. Bourne,	1886–91	WM. D. PENNELL,	1902–
John Kilburn,	1870–80	G. P. GRANT, Jr.,	1903–
William P. Haines,	1874–78	P. A. MATHEWSON,	1903–

AUDITORS.

BENJAMIN SAUNDERS,	1865–71	J. HERBERT SAWYER,	1882–00
JOHN C. PALFREY,	1871–73	C. E. ROBERTS,	1900–
HENRY D. SULLIVAN,	1873–82		

SECRETARY AND TREASURER.

AMBROSE EASTMAN,	1865–94	C. J. H. WOODBURY,	1894

MEMBERS OF THE ASSOCIATION.

October 1, 1903.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, or any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

George Arms	Grand Hotel	New York City	Oct. 16, 1872.
Henry Smith Pritchett, LL.D.,	Pres. Mass. Institute of Technology,	Boston, Mass.	Sept. 26, 1901.
Samuel Webber	Hydraulic Engineer	Charlestown, N. H.	Apr. 20, 1865.

ACTIVE MEMBERS.

Alfred E. Adams	Agt. Whitinsville Cotton Mills Agt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.	Supt. Adams Bros. Mfg. Co. 120 Commercial St.,	Adams, Mass.	Apr. 29, 1896.
Joseph D. Aiken	Asst. Supt. Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co. 37 Weybosset St., Box 34,	Providence, R. I.	Apr. 28, 1886.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
William Ames	Treas. Fletcher Manufg. Co., Box 83, 47 Charles St.,	Providence, R. I.	Apr. 30, 1879.
Charles B. Amory	Treas. Hamilton Manufg. Co. 70 Kilby St.,	Boston, Mass.	Apr. 25, 1894.
Frederic Amory	Treas. Nashua Mfg. Co. and Jackson Mfg. Co. Room 51, Simmons B'l'd., 40 Water St.,	Boston, Mass.	Apr. 27, 1899.
Thomas Armstrong	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 28, 1897
Abel T. Atherton	Machine Maker	Bay Side, R. I.	Oct. 16, 1872.
William F. Arthur	Supt. Nashua Mfg. Co.	Nashua, N. H.	Apr. 23, 1903.

Edward Atkinson	Prest. Boston Mfrs. Mu. Fire Ins. Co.	31 Milk St., Boston, Mass.	Apr. 19, 1871.
E. W. Atkinson	Stoddard, Haserick, Richards & Co.	152 Congress St., Boston, Mass.	Oct. 27, 1886.
H. C. Atwood	Treas. Williamsville Manufg. Co.	Killingly, Conn.	Apr. 29, 1885.
James A. Atwood	Agt. Wauregan Co. and Quinebaug Co.	Wauregan, Conn.	Oct. 28, 1891.
John Walter Atwood	Supt. Wauregan Co.	Wauregan, Conn.	Oct. 25, 1895.
W. E. Atwood	Pres. Williamsville Manufg. Co.	Killingly, Conn.	Sept. 27, 1894.
George A. Ayer	Supt. West Boylston Co.	Easthampton, Mass.	Apr. 24, 1895.
Nathaniel F. Ayer	Agt. Farwell Mills	Lisbon, Me.	Apr. 25, 1901.
G. H. T. Babbitt	Buyer Chicopee Mfg. Co.	340 Grove St., Chicopee Falls, Mass.	Oct. 2, 1902.
J. W. Bailey	Principal, The Bradford Durfee Textile School	Fall River, Mass.	Apr. 23, 1903.
Dickerson G. Baker	Mech. Eng., American Thread Co.	P. O. Box B, Willimantic, Conn.	Oct. 18, 1900.
Edwin H. Baker	Bliss, Fabyan & Co., Box 2899	117 Duane St., New York City, N. Y.	Apr. 24, 1878.
Edward R. Ballou	Treas. Ballou Yarn Co.,	189 Charles St., Providence, R. I.	Apr. 25, 1894.
Frederick D. Ballou	Supt. W. A. Slater Mills	Jewett City, Conn.	Apr. 23, 1903.
William P. Bancroft	Vice-Pres. Joseph Bancroft & Sons Co.	Wilmington, Del.	Oct. 31, 1883.
Louis B. Barker	Agt. United States Cotton Co.	Central Falls, R. I.	Apr. 27, 1899.
V. T. Barber	Supt. Slater Cotton Co.	Pawtucket, R. I.	Oct. 2, 1902.
Lewis E. Barnes	Agt. Pemberton Co. & Methuen Co.,	Methuen, Mass.	Oct. 25, 1895.
William A. Barrell	Agt. Lawrence Duck Co.	Lawrence, Mass.	Apr. 30, 1884.
Thomas Barrett, Jr.	Pres. Langley & Aiken Mills	Augusta, Ga.	Apr. 26, 1900.
Edwin N. Bartlett	Supt. Sigourney and Rockdale Mills,	North Oxford, Mass.	Apr. 29, 1891.
Daniel Moore Bates	Asst. Supt. Joseph Bancroft & Sons Co.,	Rockford, Wilmington, Del.	Apr. 27, 1898.
Joseph P. Battles		10 Hammond St., Worcester, Mass.	Oct. 25, 1895.
Edward C. Beach	Supt. Gate City Cotton Mills	East Point, Georgia	Oct. 5, 1899.
C. Enos Bean	Agt. Lawrenceville Mfg. Co.	Lawrenceville, Ga.	Apr. 24, 1902.
George W. Bean	Agt. Androscoggin Mills	Lewiston, Me.	Apr. 17, 1872.
Robert Beatty	Robert Beatty & Co.	Coral and Adams Sts., Philadelphia, Pa.	Oct. 28, 1897.
Truman Beckwith	Treas. Dyerville Manufg. Co.	610 Manton Ave., Providence, R. I.	Apr. 27, 1892.
John W. Bell	Asst. Treas. and Gen. Mgr. Smith & Dove Manufg. Co.	Andover Mass.	Oct. 28, 1897.
Albert Farwell Bemis	Pres. Jackson Fibre Co., (Jackson, Tenn.)	P. O. Box 5173, 89 State St., Boston, Mass.	Apr. 23. 1903.

A. C. Bent	Agt. Safety Seamless Pocket Co.	Taunton, Mass.	Oct. 28, 1897.
William H. Bilbrough	Mgr. and Treas. Elmira Knitting Mills and Mgr. Conewawah Spinning Co.,	Elmira, N. Y.	Apr. 24, 1902.
W. N. Blackstone	Treas. Attawaugan Co. Treas Totokett Mills Co	Norwich, Conn.	Apr. 29, 1896.
Wm. Washington Blades,	Gen. Supt. Lorraine Mfg. Co. 135 Mineral Spring Ave.,	Pawtucket, R. I.	Oct. 25, 1893.
T. Ashby Blythe	Proprietor Ashby Cotton Mills 114 Chestnut St.,	Philadelphia, Pa.	Oct. 28, 1897.
John P. Bodge	Treas. Arkwright Mills	Fall River, Mass.	Oct. 28, 1897.
Jefferson Borden, Jr.	Supt. Fall River Bleachery Co.	Fall River, Mass.	Apr. 21, 1899.
Nathaniel B. Borden	Treas. Barnard Manufg. Co.	Fall River, Mass.	Oct. 15, 1873.
Richard B. Borden	Treas. Richard Borden Mfg. Co. Treas. Troy C. & W. Mfg. Co.	Fall River, Mass.	July 19, 1865.
E. S. Boss	Agt. American Thread Co.	Willimantic, Conn.	Oct. 29, 1879.
A. E. Bosworth	Supt. Bernon Mills	Georgiaville, R. I.	Oct. 2, 1902.
Henry Deane Bourne	Treas. Hooksett Mfg. Co., 1741 Elm St.	Manchester, N. H.	Oct. 18, 1900.
Stephen N. Bourne	Agt. Dundee Mills	1741 Elm St., Manchester, N. H.	Oct. 21, 1868.
Frank A. Bowen	Supt. Appleton Co.	Lowell, Mass.	Apr. 28, 1897.
Arthur F. Brackett	Supt. Royal Arctic & Valley Queen Mills,	Riverpoint, R. I.	Oct. 25, 1895.
Albert W. Brainerd		Box 33, Lawrence, Mass.	Apr. 27, 1898.
S. Parker Bremer	Treas. Monadnock Mills 4 Winthrop Sq.,	Boston, Mass.,	Oct. 2, 1902.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.
George T. Briggs,	Pres. and Gen. Mgr. The Briggs Mfg. Co.	Voluntown, Conn.,	Apr. 24, 1902.
Christopher P. Brooks	Managing Director New Bedford Textile School	New Bedford, Mass.	Apr. 28, 1897.
Henry R. Brown	Supt. Phenix Mill	Box 56, Phenix, R. I.	Apr. 28, 1897.
Isaac A. Brown	Treas. Narragansett Mills	Box 324, Fall River, Mass.	Sept. 29, 1898.
James W. Brown		P. O. Box 312, Ipswich, Mass.	Oct. 15, 1873.
O. S. Brown	Agt. Salmon Falls Manufg. Co.	Salmon Falls, N. H.	Apr. 21, 1875.
Thomas J. Brown	George Brown's Sons	Mt. Joy, Penn.	Oct. 28, 1897.
E. C. Bucklin	Treas. Interlaken Mills Butler's Exchange, Box 289,	Providence, R. I.	Apr. 25, 1883.
Harris H. Bucklin	Asst. Treas. Interlaken Mills	Providence, R. I.	Apr. 23, 1903.
Robert Burgess	Treas. Slater Cotton Co. 128 Walcott St.,	Pawtucket, R. I.	Apr. 27, 1892.
Edward N. Burke	Lowell Machine Shop 216 Nesmith St.,	Lowell, Mass.	Apr. 28, 1880.
Alfred H. Burnham	Mgr. Glasgow Mills, Station Kensington Huntington and Jasper Sts.,	Philadelphia, Pa.	Apr. 26, 1900.
Hervey Burnham	Supt. Beaver Mills and Eclipse Mill 234 East Main St.,	North Adams, Mass.	Apr. 27, 1899.
W. R. Burnham		Norwich, Conn.	Apr. 29, 1885.
John L. Burton	Agt. Newmarket Mfg. Co.	Newmarket, N. H.	Apr. 23, 1903.

William H. Cadwell	Agt. Jackson Company	Nashua, N. H.	Apr. 26, 1900.
John P. Campbell	Supt. New York Mills,	New York Mills, Oneida Co., N. Y.,	Sept. 22, 1896.
Byron F. Card	Mgr.	300 Chestnut St., Philadelphia, Pa.	Apr. 25, 1888.
Samuel A. Carter	Pres. Gate City Cotton Mills	Atlanta, Ga.	Sept. 26, 1901.
George A. Chace	Treas. Bourne Mills	Box 115, Fall River, Mass.	Apr. 25, 1877.
John W. Chafee	Pres. and Treas. The Sibley Mfg. Co.	Augusta, Ga.	Oct. 18, 1900.
Simeon B. Chase	Treas. King Philip Mills	Fall River, Mass.	Apr. 21, 1875.
Chas. E. Childs	Treas. Hampton Co., Asst. Treas. West Boylston Co.	Northampton, Mass.	Oct. 1, 1903.
Clarence N. Childs	Asst. Supt. Hamilton Manufg. Co.	43 Pine St., Lowell, Mass.	Apr. 24, 1895.
Elmer G. Childs	Agt. Boston Duck Co.	Bondsville, Mass.	Oct. 26, 1892.
Jno. H. C. Church	Treas. and Gen. Mgr. Monument Mills,	Housatonic, Mass.	Apr. 28, 1897.
Daniel Clark	Wingohocking Cotton Mill,	Frankford, Philadelphia, Pa.	Apr. 23, 1903.
Ernest E. Clark	Mech. Supt. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 29, 1896.
E. N. Clemence	Cotton Manufacturer	Columbus, Ga.	Apr. 28, 1897.
W. H. Cloher, Jr.	Treas. and Agt. Utica Cotton Co.	Capron, Oneida Co., N. Y.,	Sept. 22, 1896.
Josiah G. Coburn	99 Washington St.,	Newton, Mass.	Apr. 20, 1865.
Charles H. Collins	Supt. Berkeley Co.	Ashton, R. I.	Apr. 26, 1900.
John A. Collins	Supt. American Linen Co.	73 Cottage St., Fall River, Mass.	Oct. 31, 1883.
B. B. Comer	Pres. and Treas. Avondale Cotton Mills	Birmingham, Ala.	Apr. 26, 1900.
Frank B. Comins	Treas. American Moistening Co.	150 Devonshire St., Room 67, Boston, Mass.	Oct. 28, 1891.
Caesar Cone	Pres. Proximity Mfg. Co.	Greensboro, N. C.	Apr. 26, 1900.
John J. Connell	Agt. Tremont & Suffolk Mills	Lowell, Mass.	Apr. 27, 1892.
Halsey Connett	Supt. Clark Mile End Spool Cotton Co.	East Newark, N. J.	Oct. 2, 1902.
Peter H. Corr	Treas. Greenwich Bleachery	Taunton, Mass.	Apr. 24, 1895.
Frank H. Cotton	Mgr. Hope Mills Mfg. Co.	Hope Mills, N. C.	Apr. 27, 1899.
Lyman M. Cousens,	Pres. Dana Warp Mills	Portland, Me.	Apr. 24, 1902.
Alphonse S. Covel	Treas. Tremont and Suffolk Mills,	P. O. Box 1716, 70 Kilby St., Boston, Mass.	Oct. 31, 1877.
Richard Cowell		290 Summer St., New Bedford, Mass.	Apr. 24, 1902.
William W. Crapo	Pres. Wamsutta Mills	New Bedford, Mass.	Sept. 29, 1898.
William J. Cray	Supt. Aldrich Mfg. Co.	Moosup, Conn.	Apr. 25, 1901.
Mark B. Creed	Supt. 1, 2, 3 Wamsutta Mills	New Bedford, Mass.	Oct. 1, 1903.
John B. Cudlip	Mgr. Cornwall & York Cotton Mills Co.	St. John, N. B.	Apr. 28, 1897.
H. H. Culver	Supt. Elizabeth Poole Mills	39 Ashland St., Taunton, Mass.	Apr. 28, 1897.
Henry S. Culver	Supt. Westville Cotton Mills	Taunton, Mass.	Apr. 28, 1897.
A. G. Cumnock	Treas. Appleton Co.	Box 2284, Lowell, Mass.	July 19, 1865.
Andrew J. Currier	Gen. Supt. N. E. Cotton Yarn Co.	Taunton, Mass.	Apr. 25, 1888.

Philip Dana	Supt. Dana Warp Mills	Westbrook, Me.	Sept. 29, 1898.
Woodbury K. Dana	Treas. Dana Warp Mills	Westbrook, Me.	Apr. 25, 1888.
Albert W. Danforth	Mech. Eng. Shanghai Cot. Cloth Mills, Shanghai, China	881 Bridge St., Lowell, Mass.	Apr. 27, 1881.
A. Lockwood Danielson	Asst. Treas. Quinebaug Co., Box 900,	Providence, R. I.	Sept. 27, 1894.
J. DeForest Danielson	Asst. Treas. Lockwood Co. & Lewiston Bleachery & Dye Works	Providence, R. I.	Sept. 27, 1894.
John W. Danielson	Treas. Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., Lewiston B. & D. Works, Box 900,	Providence, R. I.	July 15, 1868.
E. W. Davenport	Supt. Brighton Mills	Passaic, N. J.	Apr. 23, 1903.
Bradford D. Davol	Pres. Barnard Mfg. Co., P. O. Box 93,	Fall River, Mass.	Apr. 25, 1877.
Albert Deabill	Supt. Lowell Hosiery Co., Mt. Vernon St.	Lowell, Mass.	Apr. 25, 1901.
Augustus De Cort	Treas. Beacon Mfg. Co.	P. O. Box 2815, 65 Franklin St., Boston, Mass.	Apr. 26, 1900.
George DeForest	Treas. Utica Steam & Mohawk Valley Cotton Mills	Utica, New York	Oct. 28, 1897.
William P. Dempsey	Treas. and Mgr. Dempsey Bleachery and Dye Works	Pawtucket, R. I.	Apr. 28, 1886.
Charles W. Dennett	Vice Pres. and Agt. Johnson-Dunbar Mills Co.	North Adams, Mass.	Oct. 29, 1890.
Edward P. Dennis	Lowell Machine Shop	Lowell, Mass.	Apr. 25, 1888.
Charles A. Denny		Leicester, Mass.	Apr. 25, 1888.
P. Y. DeNormandie	Treas. Pepperell Mfg. Co.	30 Kilby St., Boston, Mass.	Apr. 29, 1896.
Charles Owen Dexter	Mgr. Canadian Colored Cotton Mills Co. Ltd.	Hamilton, Ont., Can.	Apr. 24, 1895.
Henry C. Dexter,	Agt. and Sec. Greene & Daniels Mfg. Co.	Pawtucket, R. I.	Apr. 25, 1901.
Lewis Dexter, Jr.	Mgr. The Canadian Colored Cotton Mills Co., Ltd.	Milltown, N. B.	Apr. 27, 1899.
Albert W. Dimick	Agt. Fisher Mfg. Co.	Fisherville, Mass.	Apr. 25, 1894.
Bradford C. Divine	Supt. Utica Willowvale Bleaching Co.	Chadwicks, N. Y.	Apr. 27, 1899.
Robert Dow,	Partner in Solway Mills,	Westerly, R. I.	April 25, 1901.
Arthur J. Draper	Treas. Pell City Mfg. Co.	Pell City, Ala.	Apr. 23, 1903.
Eben S. Draper	Agt. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George A. Draper	Treas. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George Otis Draper	Sec'y Draper Co.	Hopedale, Mass.	Apr. 24, 1895.
William F. Draper	Pres. Draper Co.	Hopedale, Mass.	July 17, 1867.
William F. Draper, Jr.	Draper Co.	Hopedale, Mass.	Oct. 29, 1890.
Harry K. Drew	Supt. Clinton Mfg. Co., 93 Clinton St.,	Woonsocket, R. I.	Apr. 24, 1902.
O. D. Drew	Supt. Peabody Manufacturing Co.	Newburyport, Mass	Oct. 2, 1902.
James B. Duggan	Pres. Union Bleaching and Finishing Co.	Greenville, S. C.	Oct. 2, 1902.
Frederic C. Dumaine,	Treas. Amory Mfg. Co., Box 2879	64 Ames Building, Boston, Mass.	April 25, 1901.
Joseph M. Dunham		43 Edwards St., Springfield, Mass.	Oct. 26, 1892.

John H. Dunn . . . . Supt. Tremont & Suffolk Mills . . . Lowell, Mass. . . . Oct. 1, 1903.
Frank J. Dutcher . . . Asst. Agt. Draper Co. . . . . Hopedale, Mass. . . Apr. 24, 1902.
Frank H. Dwelly . . . Treas. Tecumseh Mills . . . . . Fall River, Mass. . . Apr. 27, 1899.
David H. Dyer . . . . D. H. Dyer & Son, Mill Engineers, P. O. Box 582, . . .
. . . . . 6, 7 and 8 Pocassett Bank Building, Fall River, Mass. . . Oct. 18, 1871.

Benjamin M. Earle . . Prop. Merchants Dye Works . . . . East Dedham, Mass. Sept. 26, 1901.
Wm. Ambrose Eastman, Gen. Mgr. Hooper Knitting Co. . . Lowell, Mass. . . . Apr. 24, 1878.
Russell W. Eaton . . . Agt. Cabot Manufg. Co. . . . . Brunswick, Me. . . . Oct. 27, 1887.
John Eccles . . . . . Agt. Ponemah Mills . . . . . Taftville, Conn. . . . Apr. 27, 1892.
Oscar Elsas . . . . . Vice-Pres. Fulton Bag & Cotton Mills, ...
. . . . . P. O. Box 773, Atlanta, Ga. . . . . Apr. 28, 1897.
Frederick W. Ely . . . Agt. Columbian Manufg. Co. . . . Greenville, N. H. . . Apr. 25, 1888.
H. B. Estes . . . . . Agt. Continental Mills . . . . . Lewiston, Me. . . . Apr. 26, 1893.
John H. Estes . . . . Cotton Manufacturer . . . . . Fall River, Mass. . . Apr. 23, 1903.
William Evans . . . . Treas. Wampanoag Mills . . . . . Fall River, Mass. . Apr. 29, 1896.
D. A. Everly . . . . . Pres. . . . . 96 Broad St., Pawtucket, R. I. . . Apr. 24, 1902.

Charles F. Farrar . . . . . 22 Coggeshall St., Fall River, Mass. . . Oct. 28, 1897.
George E. Farrell . . . Treas. Utica Spinning Co. . . . . Utica, N. Y. . . . . Oct. 18, 1900.
James T. Ferguson . . Supt. Warwick Mills . . . . . Centreville, R. I. . . Oct. 5, 1899.
Frank S. Field . . . . Supt. & Agt. Massaemit Yarn Mills . Shattuckville, Mass. . Oct. 25, 1895.
William Firth . . . . Pres. American Moistening Co. & Wm. Firth Co. . . . .
. . . . . P. O. Box 1460, 150 Devonshire St., Room 67, Boston, Mass. Apr. 25, 1888.
Charles H. Fish . . . . Agt. Cocheco Manufg. Co. . . . Dover, N. H. . . . . Apr. 27, 1887.
Charles W. Fisher, . . Asst. Supt. Fisher Mfg. Co. . . . . Fisherville, Mass. . . Apr. 25, 1901.
Henry E. Fisher . . . Vice-Pres. & Agt. Atlanta Cotton Mills Atlanta, Ga. . . . . Oct. 25, 1895.
Herbert Fisher . . . . . Taunton, Mass. . . . Oct. 29, 1879.
Frederick A. Flather . Gen. Supt. Manufacturing International Harvester Co. . .
. . . . . 7 Monroe St., Chicago, Ill. . . . . Apr. 29, 1891.
F. C. Fletcher . . . . Vice Pres. Lawton Spinning Co. . . . . .
. . . . . 621 Banigan Building, Providence, R. I. . . Oct. 18, 1900.
Henry J. Forsyth . . . Supt. The Sibley Mfg. Co. . . . Augusta, Ga. . . . Oct. 1, 1903.
M. F. Foster . . . . . Milford, N. H. . . . Apr. 17, 1872.
Philip H. Fowler . . . . . 417 Monmouth St., Gloucester City, N. J. Nov. 30, 1881.
Edward W. France . . Dir. of Philadelphia Textile School, ...
. . . . . 320 So. Broad St., Philadelphia, Pa. . . Sept. 22, 1896.
Arthur C. Freeman . . Textile Finishing Machinery Co. . . . . .
. . . . . 17 Exchange Place, Providence, R. I. . . Apr. 27, 1899.
Simon Friedberger . . Pres. Friedberger Mfg. Co. . . . . .
. . . . . Germantown, Logan Station, Philadelphia, Pa. . . Apr. 23, 1903.
John W. Fries . . . . Managing Partner, F. & H. Fries, . Winston-Salem, N. C. Oct. 18, 1900.
C. H. Frisbie . . . . . Agt. Attawaugan Co. . . . . Norwich, Conn. . . . Oct. 29, 1890.

W. T. Galey . . . . . Pres. Aberfoyle Manufg. Co. . . . Chester, Pa. . . . . Apr. 28, 1897.
William Gammell . . . Agt. Berkeley Co. . . . . Providence, R. I. . . . Oct. 28, 1885.
James G. Garland . . . . . Saco, Me. . . . . Oct. 29, 1879.
Edward T. Garsed . . Supt. Pell City Mfg. Co. . . . . Pell City, Ala. . . . Apr. 27, 1898.
Walter R. Garsed . . . Mgr. Wingohocking Cotton Mills . . . . . Frankford, Philadelphia, Pa. . . Oct. 1, 1903.
E. Stanley Gary . . . Vice Pres. and Gen. Mgr. Gary Mfg. Co. . . . . 108 West German St., Baltimore, Md. . . . Oct. 1, 1903.
James A. Gary . . . . Pres. Gary Mfg. Co. 108 German St., Baltimore, Md. . . . Apr. 25, 1883.
James Gee . . . . . Supt. Interlaken Dye Works . . . . Fiskville, R. I. . . . Apr. 27, 1898.
Charles E. Getchell . . Pres. Waltham Emery Wheel Co. . . . . Bacon St., Waltham, Mass. . . . Oct. 30, 1889.
William C. Godfrey . . Agt. Indian Orchard Co. . . . . Indian Orchard, Mass. Oct. 29, 1890.
Otto Goetze, ... Partner and Gen. Mgr. Glasgow Mills, Huntington and Jasper Sts., Kensington Sta., Philadelphia, Pa. . . Apr. 24, 1902.
Alfred M. Goodale . . Treas. Boston Manufg. Co. . . . . 50 State St., Boston, Mass. . . . . Apr. 25, 1883.
Louis B. Goodall . . . Treas. Goodall Worsted Co. . . . . Sanford, Me. . . . . Oct. 5, 1899.
Frederick B. Gordon . Pres. Columbus Mfg Co. . . . . Columbus, Ga. . . . Apr. 26, 1900.
Charles H. Gorton . . Supt. Columbus Mfg. Co. . . . . Columbus, Ga. . . . Apr. 25, 1894.
Marcellus Gould . . . Pres. and Mgr. N. H. Spinning Mills, Penacook, N. H. . . Sept. 22, 1896.
George P. Grant, Jr. . . Treas. Grant Yarn Co. . . . . Fitchburg, Mass. . . Sept. 27, 1894.
D. W. Gray . . . . . Supt. Skenandoa Cotton Co. . . . . Utica, N. Y. . . . . Oct. 26, 1892.
R. A. Gray . . . . . Supt. Rodman Manufg. Co. . . . . Allenton, R. I. . . . Apr. 24, 1895.
Frederick Stuart Greene Mgr. Transmission Rope Dept., The American Mfg. Co. . 65 Wall St., New York City . . . Oct. 1, 1903.
Joseph Warren Greene . Supt. . . . . Wickford, R. I. . . . Apr. 29, 1896.
William C. Greene . . Treas. Peace Dale Manufg. Co. . . Peace Dale, R. I. . . . Oct. 27, 1886.
John T. Greenwood . . R. Greenwood & Bault . . . . . 4720 Leiper St., Frankford, Philadelphia, Pa. . . Apr. 26, 1900.
S. Greenwood . . . . Mgr. Canadian Col'd Cot. Mills Co. Ltd. . . . . Cornwall, Ontario . . Oct. 5, 1899.
John Gregson . . . . Agt. Fiskdale Mills . . . . . Fiskdale, Mass. . . . Apr. 24, 1895.
Maxwell Grierson . . . Gen. Mgr. Jas. Chadwick & Bro., Ltd., Jersey City, N. J. . . Apr. 27, 1898.
Frederick Grinnell . . Pres. Gen. Fire Extinguisher Co. . . New Bedford, Mass. . Apr. 24, 1878.
David Grove . . . . . Supt. U. S. Cotton Co. . . . . Central Falls, R. I. . Apr. 27, 1898.
Henry S. Grove . . . Pres. Argo Mills Co., ... 318 Marine and Merchant Bldg., Philadelphia, Pa. . . Apr. 27, 1898.
Louis I. Guion . . . . Supt. Columbia Mills Co., ... Columbia, S. C. . . . Oct. 2, 1902.
Arthur H. Gulliver . . Agt. Boston Mfg. Co. . . . . Waltham, Mass. . . Apr. 24, 1889.

William J. Hadfield . . Newburgh Steam Mills, ... 124 Smith St., Newburgh, N. Y. . . Apr. 27, 1899.
Frank J. Hale . . . . Gen. Agt. Saco and Pettee Machine Shops . . . . . Newton Upper Falls, Mass. . Apr. 27, 1892.
Walter B. Hall . . . . Supt. Pontiac Mill, B. B. & R. Knight, Pontiac, R. I. . . . . Apr. 25, 1901.

William E. Hall	Treas. and Mgr. Shaw Stocking Co.,	Lowell, Mass.	Apr. 27, 1892.
Z. D. Hall	Supt. Berkshire Cotton Mfg. Co. 70 Orchard St., P. O. Box 963,	Adams, Mass.	Oct. 29, 1879.
William Halliwell,	Agt. Providence and Woonsocket Mills of the Lawton Spinning Co.,	Woonsocket, R. I.	Sept. 26, 1901.
John H. Hambly	Treas. Quidnick Manufg. Co. 49 Westminster St,	Providence, R. I.	Apr. 24, 1895.
Arthur M. Hamilton	Supt. Hargraves and Parker Mills 267 Hanover St.,	Fall River, Mass.	Apr. 28, 1897.
John F. Hamlet	Manufacturer	P. O. Box 160, Fall River, Mass.	Oct. 31, 1888.
Joseph O. Hannum		1805 10th Ave. South, Birmingham, Ala.	Apr. 30, 1890.
Peter Hardman	Supt. American Thread Co., Willimantic Mills	Willimantic, Conn.	Apr. 23, 1903.
A. G. Harris		West Warrren, Mass.	Sept. 26, 1901.
Henry F. Harris	Treas. West Boylston Manufg. Co. 340 Main St.,	Worcester, Mass.	Apr. 30, 1890.
W. G. Hartford	Agt. Hamlet Textile Co.	Woonsocket, R. I.	Apr. 23, 1903.
William D. Hartshorne	Agt. Arlington Mills	Lawrence, Mass.	Apr. 27, 1899.
Walter M. Hastings	Asst. Agt. Arlington Mills	Lawrence, Mass.	Apr. 23, 1903.
Samuel E. Hathaway	Supt. Fall River Iron Works Co.	Fall River, Mass.	Sept. 27, 1894.
William Hathaway	Supt. Barnard Manufg. Co.	Fall River, Mass.	Apr. 25, 1894.
William B. Hawes	Yarn Broker 108 Bedford St., P. O. Box 733,	Fall River, Mass.	Apr. 24, 1895.
Alfred Hawkesworth	Supt. Merchants' Cotton Co.	Montreal, P. Q.	Apr. 26, 1893.
Fred Hawkesworth	Asst. Supt. Merchants' Cotton Co.	Montreal, P. Q.	Sept. 22, 1896.
William Hayes	Agt. Barker Mill	Auburn, Me.	Apr. 30, 1879.
W. G. Henderson	Agt. Falls Co.	Norwich, Conn.	Apr. 29, 1896.
A. E. Henry,	Mfr. Partner in Solway Mills,	Westerly, R. I.	Apr. 25, 1901.
James Henry	Thos. Henry & Sons Trenton Ave. and Tioga St.,	Philadelphia, Pa.	Oct. 1, 1903.
William G. Henry	Thos. Henry & Sons Trenton Ave. and Tioga St.,	Philadelphia, Pa.	Oct. 1, 1903.
Ernest L. Hersom	Supt. Nockege Mill	Fitchburg, Mass.	Apr. 23, 1903.
T. I. Hickman,	Pres. and Treas. Graniteville Mfg. Co. Leonard Bldg.,	Augusta, Ga.	Apr. 25, 1901.
Hiram Higham	Supt. 6 and 7 Wamsutta Mills	New Bedford, Mass.	Oct. 1, 1903.
Ernest L. Hill	Vice-Pres. Renfrew Mfg. Co. 320 Broadway,	New York City	Apr. 24, 1902.
William H. Hill	Pres. Windsor Co. and Pres. Renfrew Mfg. Co. 40 Water St.,	Boston, Mass.	Apr. 24, 1902.
George H. Hills	Treas. Davol Mills & Stevens Mfg. Co.,	Fall River, Mass.	Oct. 25, 1895.
Charles H. Hobbs	Agt. Thorndike Co.	Thorndike, Mass.	Apr. 28, 1886.
Franklin W. Hobbs	Treas. Arlington Mills P. O. Box 5317, 78 Chauncy St.,	Boston, Mass.	Apr. 27, 1899.
William Henry Hobbs	Asst. Supt. Johnson & Johnson Co.,	New Brunswick, N. J.	Apr. 24, 1902.
Louis L. Hohn	Cor. Connecticut Ave. and McDonald St.,	New London, Conn.	Apr. 28, 1897.
Charles M. Holmes	Supt. Natick Mills	Natick, R. I.,	Apr. 27, 1899.

Gideon F. Holmes . . Treas. and Gen. Mgr. Plymouth Cordage Co. . . . . No. Plymouth, Mass. . Oct. 30, 1889.
George W. Holt . . . Agt. Monohansett Manufg. Co. . . Putnam, Conn. . . . Oct. 29, 1879.
John H. Holt . . . . Supt. Totokett Mills Co. . . . . Versailles, Conn. . . Apr. 23, 1903.
Walter L. Holt . . . . Pres. Holt-Morgan Mills . . . . . Fayetteville, N. C. . . Oct. 18, 1900.
William P. Holt . . . Supt. Barnaby Mills . . . . . Fall River, Mass. . . Oct. 25, 1893.
Wm. E. Hooper . . . Mgr. Woodberry Div. of Mt. Vernon Woodberry Co. . . . . Room 804, Continental Trust Bldg., Baltimore, Md. . . . Apr. 23, 1903.
Edward W. Houghton . Supt. Globe Mill . . Manville Co., Woonsocket, R. I. . . Apr. 24, 1902.
Henry S. Houghton, Jr. Supt. Paul Whitin Manufg. Co. . . Northbridge, Mass. . Apr. 24, 1895.
W. C. Houston . . . . Pres. Hope Mills Manufg. Co. . . . . 333 Drexel Building, Philadelphia, Pa. . . Apr. 28, 1897.
Elisha H. Howard . . Cotton Goods Broker, 20 Market Sq., Providence, R. I. . . Apr. 25, 1883.
Henry S. Howe . . . . Dry Goods Commission . . . . . 89 Franklin St., Boston, Mass. . . . Oct. 31, 1877.
Albert C. Hoy . . . . . Woonsocket, R. I. . . Apr. 27, 1898.
Charles W. Hubbard . Treas. and Sec. Ludlow Mfg. Associates . . . . . 133 Essex St., Boston, Mass. . . . Apr. 25, 1901.
Otis L. Humphrey, . . Cotton Dept. Lowell Textile School, Lowell, Mass. . . . Apr. 25, 1901.
Arthur W. Hunking . . . . . 374 Stevens St., Lowell, Mass. . . . Apr. 24, 1895.
George A. Hurd, ... 76 Broadway, Dover, N. H. . . . . Apr. 25, 1901.

D. Edwin Irving . . . Treas. The Irving & Leiper Mfg. Co., Chester, Pa. . . . . Oct. 28, 1897.

Joseph B. Jamieson . . Mgr. Boston Office of New England Cotton Yarn Co. . . . . 77 Summer St., Boston, Mass. . . . Oct. 2, 1902.
J. E. Jenckes . . . . Treas. E. Jenckes Manufg. Co. & E. Jenckes Spinning Co. . . . . Pawtucket, R. I. . . Apr. 24, 1895.
Edward B. Jennings . . Treas. Samoset Co. . . . . Valley Falls, R. I. . . Sept. 29, 1898.
John L. Jerome . . . . Treas. Overland Cotton Mill Co. . . Denver, Col. . . . . Apr. 23, 1903.
David L. Jewell . . . Agt. China, Webster & Pembroke Mills . Suncook, N. H. . Apr. 20, 1865.
Leonard Johnson . . . Supt. Wampanoag Mills . . . . . 33 Cambridge St., Fall River, Mass. . . Oct. 1, 1903.
David S. Johnston . . Gen. Supt. Harmony Mills . . . . Cohoes, N. Y. . . . Oct. 28, 1891.
Gordon A. Johnstone . Agt. Danielson Cotton Co. . . . . Danielson, Conn. . . Apr. 23, 1903.
W. T. Jordan . . . . Mgr. Mountain Island Mfg. Co. . . Mountain Island, N. C. Oct. 25, 1895.

W. E. Keach . . . . . Supt. Grant Yarn Co., 21 Burnap St., Fitchburg, Mass. . . Oct. 26, 1892.
Roland R. Kelly . . . Supt. Williamstown Manufg. Co. . Williamstown Sta., Mass. Nov. 30, 1881.
George E. Kent . . . . Treas. Exeter Manufg. Co. . . . . Exeter, N. H. . . . Oct. 31, 1888.
Hervey Kent . . . . . Pres. Exeter Manufg. Co. . . . . Exeter, N. H. . . . Apr. 20, 1865.
Nathaniel B. Kerr . . . Treas. Butler Mill . . . . . New Bedford, Mass. . Oct. 26, 1892.
John Kilburn . . . . . Belmont, Mass. . . . Apr. 20, 1865.
Harry W. Kimball . . Supt. Fulton Bag & Cotton Mills . Atlanta, Ga. . . . . Oct. 25, 1895.
William N. Kimball . . Supt. Social and Nourse Mills, Manville Co. . . . . Woonsocket, R. I. . . Apr. 24, 1902.

Emil Kipper . . . . . Treas. Renfrew Mfg. Co. and Windsor Print Works . . . . . Adams, Mass. . . . . Apr. 24, 1902.
Albert F. Knight . . . Mfr. Fine White Cotton Goods and Yarns . . . . . Box 835, Providence, R. I. . . Oct. 27, 1886.
Jesse A. Knight . . . . Supt. Cohannet Mills . . . . . Taunton, Mass. . . . Oct. 26, 1892.
Stephen A. Knight . . Pres. Hebron Manufg. Co., Box 820, Providence, R. I. . . Oct. 21, 1868.
Walter B. Knight . . . Reynolds Manufg. Co. . . . . Davisville, R. I. . . Apr. 24, 1889.
Webster Knight . . . B. B. & R. Knight's Mills . . . . . 3 Washington Row, Providence, R. I. . . Oct. 31, 1888.

Fred Lacey . . . . . Mgr. Montreal Cotton Co. . . . . Valleyfield, P. Q. . . Apr. 24, 1895.
Elliott Cowdin Lambert Supt. Amoskeag Manufg. Co. . . . Manchester, N. H. . Oct. 25, 1895.
William T. Lang . . . Agt. Brookside Mills . . . . . Knoxville, Tenn. . . Apr. 28, 1897.
Walter H. Langshaw . Agt. Dartmouth Manufg. Corp. . . New Bedford, Mass. . Apr. 29, 1896.
George H. Law . . . Supt. Merchants' Mfg. Co. . . . . 815 Walnut St., Fall River, Mass. . . Apr. 28, 1897.
Harold Lawton . . . . Mgr. Baltic Mills Co. . . . . Baltic, Conn. . . . . Oct. 27, 1886.
John Edward Lawton . Governing Director American Thread Co., ... Matlock, Derbyshire, England . Apr. 25, 1901.
Calvin H. Lee . . . . Supt. Readville Cotton Mills . . . Hyde Park, Mass. . . Apr. 24, 1902.
Evan Arthur Leigh . . Textile Machinery . . 70 Kilby St., Boston, Mass. . . . Oct. 29, 1890.
John Leiper . . . . . Supt. Fitchburg Worsted Mills, Upland Road . . . . . Fitchburg, Mass. . . Oct. 28, 1897.
J. Colby Lewis . . . . . 23 Ralph St., Olneyville, Providence, R. I. . . Oct. 26, 1892.
Charles F. Libby . . . Supt. Shaw Stocking Co. . . . . Lowell, Mass. . . . Apr. 24, 1902.
Leontine Lincoln . . . Pres. Seaconnet Mills . . . . . Fall River, Mass. . . Apr. 28, 1897.
B. F. G. Linnell . . . Commission Merchant, Yarns, Threads and Twines . . . . . 37 Summit St., P. O. Box 645, Central Falls, R. I. . . Oct. 28, 1897.
Charles Warren Lippitt, Treas. Silver Spring B. & D. Co. . . . . 7 Young Orchard Ave., Providence, R. I. . . Oct. 30, 1878.
Henry F. Lippitt . . . Gen. Mgr. Social and Manville Cos., Providence, R. I. . . Apr. 27, 1881.
William H. Loftus . . Supt. Clark Thread Co. . . . . Newark, N. J. . . . Oct. 28, 1897.
Robert W. Lord . . . Agt. R. W. Lord & Co. . . . . Kennebunk, Me. . . Oct. 20, 1869.
Ernest Lovering . . . Agt. Lyman Mills . . . . . Holyoke, Mass. . . . Apr. 25, 1888.
Henry M. Lovering . . Agt. Whittenton Manufg. Co. . . . Taunton, Mass. . . . Oct. 27, 1880.
William C. Lovering . Pres. Whittenton Manufg. Co. . . . . 50 State St., Boston, Mass. . . . Oct. 25, 1876.
William M. Lovering . Supt. Whittenton Manufg. Co. . . . Taunton, Mass. . . . Sept. 27, 1894.
Arthur H. Lowe . . . Treas. Parkhill Mfg. Co., Treas. Wm. Lowe Mfg. Co., ... Huntsville, Ala. . . . . Fitchburg, Mass. . . Oct. 30, 1889.
David Lowe . . . . . Supt. Parkhill Manufg. Co. . . . . Fitchburg, Mass. . . Apr. 24, 1895.
A. Lawrence Lowell . Trustee . . . . . 843 Exchange Building, 53 State St., Boston, Mass. . . . Apr. 25, 1901.
Dudley T. Lyall . . . Sec. Brighton Mills . . . . . Passaic, N. J. . . . . Sept. 22, 1896.
William L. Lyall . . . Treas. Brighton Mills . . . . . Passaic, N. J. . . . . Oct. 26, 1892.
Herbert Lyman . . . . . 39 Beacon St., P. O. Box 1717, Boston, Mass. . . . Oct. 25, 1895.

Ronald T. Lyman	Asst. Treas. Boston Mfg. Co. P. O. Box 1727,	Boston, Mass.	Oct. 1, 1903.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 25, 1895.
Alvin S. Lyon	Supt. Bigelow Co.	Lowell, Mass.	Apr. 26, 1882.
James R. MacColl	Treas. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Charles L. Macomber	Pres. Winthrop Cotton Yarn Co.	Taunton, Mass.	Apr. 24, 1895.
Frederick B. Macy,	Treas. Soule Mills,	New Bedford, Mass.	Apr. 25, 1901.
Amos G. Maddox	Supt. Linwood Mill	Linwood, Mass.	Oct. 18, 1900.
Charles T. Main	Mech. and Mill Engineer, Dean & Main 53 State St., 1112 Exchange Bldg.,	Boston, Mass.	Oct. 28, 1885.
Alexander Makepeace	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Oct. 1, 1903.
Charles R. Makepeace	Mill Engineer Box 973,	Providence, R. I.	Apr. 30, 1890.
Vladimir Malinin, M. E.,	Prochoroff Three Hill Mfg. Co.	Moscow, Russia	Apr. 23, 1903.
Arthur B. Mann	J. H. Martin & Co., 99 Franklin St.,	New York, N. Y.	Apr. 25, 1894.
Charles H. Manning	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Gen. Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Paul J. Marrs	Treas. Henderson Cotton Mills	Henderson, Ky.	Oct. 28, 1897.
Albert G. Martin	Supt. Kincaid Manufg. Co. Box 182, Griffin,	Spalding County, Ga.	Apr. 30, 1884.
Henry D. Martin	Asst. Supt. Stevens Mfg. Co. 83 Warren St.,	Fall River, Mass.	Apr. 28, 1897.
Arthur H. Mason	Treas. Barnaby Mfg. Co.	Fall River, Mass.	Oct. 2, 1902.
Philip A. Mathewson	Supt. King Philip Mills Box 607,	Fall River, Mass.	Apr. 24, 1895.
Scott Maxwell,	Agt. Indian Head Mills of Ala.	Cordova, Ala.	Sept. 26, 1901.
Thomas Mayor	Textile Machinery Thomas Mayor & Son, 26 Olney St.,	Providence, R. I.	Oct. 27, 1880.
Robert McArthur	Agt. Pepperell Mfg. Co.	Biddeford, Me.	Apr. 17, 1872.
Thos. McAulifle	Supt. Stevens Mfg. Co.	Fall River, Mass.	Apr. 27, 1898.
Henry G. McCarter	Mgr. John Farnum & Co., Conestoga Mills, 2 and 3	Lancaster, Pa.	Apr. 23, 1903.
Albert E. McDonald	Agt. Lawrenceville Mfg. Co.,	Lawrenceville, Ga.	Oct. 2, 1902.
Fred C. McDuffie	Treas. Everett Mills and York Manufg. Co.	P. O. Box 2934, 40 Water St., Boston, Mass.	Oct. 25, 1882.
John G. McFadden	Supt. Nottingham Mill, 314 Dyer St.,	Providence, R. I.	Oct. 1, 1903.
James A. McLane	Supt. Davis Mills	Fall River, Mass.	Oct. 2, 1902.
William G. McLoon	Supt. Lancaster Mills,	Clinton, Mass.	Apr. 27, 1892.
Robert G. McMeehan,	Supt. Uncasville Mfg. Co.	Uncasville, Conn.	Sept. 26, 1901.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Agt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
Robert B. Meikle	Supt. Lorraine Mfg. Co.	Westerly, R. I.	Apr. 23, 1903.
Henry P. Meikleham,	Agt. Mass. Mills in Georgia	Lindale, Floyd Co., Ga.	Apr. 26, 1900.
Joseph Mercer	Agt. and Treas. Willimantic Cotton Mills Co.	Willimantic, Conn.	Apr. 24, 1902.
Charles H. Merriman, Jr.	Manville Co., Board of Trade Bldg.,	Providence, R. I.	Apr. 24, 1895.

Joseph Merriam	Pres. Springfield Webbing Co.	Middletown, Conn.	Oct. 2, 1902.
W. H. Miles		Lisbon, Me.	Sept. 22, 1896.
R. M. Miller, Jr.	Pres. & Treas. Elizabeth Mills	Charlotte, N. C.	Sept. 29, 1898.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Agt. Nashua Mfg. Co.	Nashua, N. H.	Apr. 29, 1896.
David Milne	C. J. Milne & Sons Washington Ave. & 10th and 11th Sts.	Philadelphia, Pa.	Apr. 28, 1897.
A. B. Mole	Gen. Mgr. Dominion Cotton Mills Co.	Montreal, P. Q.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Lonsdale Mills	Lonsdale, R. I.	Apr. 24, 1895.
J. R. Montgomery	Pres. The J. R. Montgomery Co.	Windsor Locks, Conn.	Sept. 29, 1898.
George A. Moody	Supt. West Warren Cotton Mills	West Warren, Mass.	Apr. 27, 1899.
Fred W. Moore	Agt. Cordis Mills P. O. Box 582	Millbury, Mass.	Apr. 27, 1892.
James Sumter Moore	Sec. and Treas. Olympia & Richland Cotton Mills	Columbia, S. C.	Apr. 26, 1900.
George B. Morison	Pres. Ballou Yarn Co., 78 Chauncy St.	Boston, Mass.	Apr. 24, 1895.
Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
E. P. Morton,	Agt. Stevens Linen Works	Webster, Mass.	Sept. 26, 1901.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 20, 1865.
Farquharson J. Muir	Cone Export & Commission Co.	Greensboro, N. C.	Apr. 27, 1892.
John Neild	Agt. Grinnell Mfg. Corp.	New Bedford, Mass.	Apr. 25, 1901.
Will Nelson	Head Instructor of Weaving, Lowell Textile School	Lowell, Mass.	Apr. 23, 1903.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 25, 1895.
William G. Nichols	Sec. and Treas. Springstein Mills and Pres. Wylie Mills	Chester, S. C.	Oct. 25, 1893.
William M. Nixon	Pres. Atlanta Woolen Mills	Atlanta, Ga.	Oct. 5, 1899.
Albert W. Noone,	Prop. & Mgr. Jos. Noone's Son's Co.	Peterboro, N. H.	Sept. 26, 1901.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
S. Odenheimer	Treas. Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Continental Bldg.	Baltimore, Md.	Sept. 27, 1894.
J. Edward Osborn	Treas. American Linen Co.	Fall River, Mass.	Apr. 28, 1897.
Henry Osgood,	6 Monroe St., P. O. Box 204,	Salem, Mass.	Apr. 25, 1901.
Frederick Ott	Supt. Hamlet Textile Co.	Woonsocket, R. I.	Apr. 23, 1903.
Herbert W. Owen	Supt. Cocheco Mfg. Co.	Dover, N. H.	Oct. 5, 1899.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whitinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Walter H. Paige	Supt. Wamsutta Mills	New Bedford, Mass.	Oct. 1, 1903.
O. B. Parker	Supt. Quidnick Mfg. Co.	Quidnick, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Cotton Mills Box 627,	Turners Falls, Mass.	Apr. 29, 1896.
Walter E. Parker	Agt. Pacific Mills, 217 Haverhill St.,	Lawrence, Mass.	Apr. 25, 1877.

Duncan D. Parmly	Treas. Johnson Mfg. Co. and Dunbar Mills Co.	160 Broadway, New York, N. Y.	Sept. 22, 1896.
Samuel F. Patterson	Pres. and Treas. Thistle Mills Co.	Ilchester, Md.	Oct. 18, 1900.
John W. Pead	Agt. Merrimack Manufg. Co.	Box 1231, Lowell, Mass.	Apr. 26, 1893.
James R. Pearce		560 South Pryor St., Atlanta, Ga.	Oct. 25, 1895.
William C. Peirce	Pres. Elizabeth Mills	564 Eddy St., Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Henry C. Phillips	Asst. Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 25, 1894.
Benjamin Phipps	Merchant	4 Winthrop Sq. Boston, Mass.	Sept. 29, 1898.
Albert R. Pierce	Supt. Pierce Mfg. Corp.	New Bedford, Mass.	Oct. 5, 1899.
Andrew G. Pierce, Jr.	Treas. Pierce Manufg. Corp.	P. O. Box, 34, New Bedford, Mass.	Apr. 24, 1895.
Reuben Pilling, Jr.		104 Harrison St., Providence, R. I.	Apr. 29, 1896.
Charles H. Plummer	Agt. Great Falls Manufg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Charles T. Plunkett	Sec. Berkshire Cotton Mfg. Co.	Adams, Mass.	Apr. 28, 1897.
William C. Plunkett	Mgr. W. C. Plunkett & Sons	Adams, Mass.	Oct. 1, 1903.
Charles H. Potter,	Supt. Montreal Cotton Co.,	Valleyfield, P. Q.,	Apr. 25, 1901.
Joseph H. Potter, Jr.	Supt. Durfee Mills	Fall River, Mass.	Apr. 27, 1899.
J. F. Powers	Supt. Spinning Mill	Middletown, Conn	Oct. 5, 1899.
Lavater W. Powers	Supt. Bristol Mfg. Co.	141 Merrimac St., New Bedford, Mass.	Oct. 1, 1903.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
George E. Prest		340 Highland St., Newton Square, Worcester, Mass.	Apr. 24, 1902.
Harry B. Prest		340 Highland St., Newton Square, Worcester, Mass.	Apr. 24, 1902.
John E. Prest		340 Highland St., Newton Square, Worcester, Mass.	Apr. 17, 1872.
M. W. Quinn	Agt. Hamilton Woolen Co.	Amesbury, Mass.	Oct. 27, 1886.
John W. Ramsbottom	Supt. Samoset Co.	Valley Falls, R. I.	Apr. 24, 1902.
Theodore Ellis Ramsdell,	Agt. Monument Mills	Housatonic, Mass.	Apr. 23, 1903.
Emory S. Rathbun	Supt. Pequot Mills	Montville, Conn.	Apr. 27, 1899.
M. A. Rawlinson	Supt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 24, 1895.
John F. Reardon	Supt. Millville Mfg. Co.	Millville, N. J.	Apr. 26, 1900.
Robert Redford	Mfr.	Box 28, Lawrence, Mass.	Apr. 26, 1882.
R. S. Reinhardt	Treas. and Mgr. Elm Grove Cotton Mills	Lincolnton, N. C.	Apr. 27, 1898.
L. B. Renfrew	Treas. Renfrew Mfg. Co.	Adams, Mass.	Oct. 5, 1899.
T. H. Rennie	Supt. Graniteville Mfg. Co.	Graniteville, S. C.	Oct. 18, 1900.
Frederick W. Reynolds,	Supt. Potomska Mills,	Box 299, 20 Fifth St., New Bedford, Mass.	Apr. 26, 1900.
Francis H. Rice	Pres. Holbrook Mfg. Co.	Millbury, Mass.	Apr. 28, 1880.
John Bion Richards	Treas. Davis Mills	Fall River, Mass.	Apr. 24, 1902.
Charles H. Richardson	Agt. Lancaster Mills	Clinton, Mass.	Apr. 24, 1889.
W. H. Richmond	Supt. Bibb Mill No. 2	Macon, Ga.	Oct. 28, 1897.

Walter Rigby . . . . Bibb Mfg. Co. . . 3163 First Ave., Columbus, Ga. . . . Apr. 26, 1900.
Charles E. Riley . . . Textile Machinery, C. E. Riley & Co. . . . . 65 Franklin St., Box 2815, Boston, Mass. . . . Apr. 25, 1888.
William H. Ritter . . . Gen. Supt. and Buyer Johnson & Johnson . . . . . 266 George St., New Brunswick, N. J. Apr. 26, 1900.
George W. Robbins . . Supt. Dyerville Mfg. Co., ... 610 Manton Ave., Providence, R. I. . . Apr. 28, 1897.
Benj. H. Roberts . . . General Mill Supplies 163 Grove St., Fall River, Mass. . . Apr. 26, 1900.
Charles D. Robinson . Supt. Crompton Co. . . . . Crompton, R. I. . . . Sept. 27, 1894.
Edwin A. Robinson . . Asst. Supt. Tremont and Suffolk Mills, Lowell, Mass. . . . . Oct. 18, 1900.
William A. Robinson . Asst. Supt. Manville Co. . . . . Woonsocket, R. I. . Apr. 29, 1896.
William H. Robinson . Supt. No. 3 Harmony Mill . . . . Cohoes, N. Y. . . . Apr. 24, 1902.
W. H. Rose . . . . . Sec'y & Treas. Richland, Granby and Olympia Cotton Mills . . . . . Columbia, S. C. . . . Oct. 18, 1900.
John K. Russell . . . Pres. and Gen. Mgr. Messenger Mills Corp. . . . . 476 Hall St., Manchester, N. H. . Apr. 29, 1891.

Alfred Sagar . . . . . Supt. Arlington Cotton Mills . . . . . 15 High St., Methuen, Mass. . . Apr. 24, 1902.
Edward H. Sanborn . . Vice Pres. Cold Spring Bleaching and Finishing Works . . . . . North American Bldg., Philadelphia, Pa. . . Oct. 18, 1900.
Arnold B. Sanford . . Pres. Kennebec Spinning Mills . . . . . 67 Chauncy St., Boston, Mass. . . . Oct. 25, 1882.
Pardon B. Sanford . . Supt. Utica Spinning Co. . . . . Utica, N. Y. . . . . Oct. 2, 1902.
J. Herbert Sawyer . . . . . 93 Federal St., Boston, Mass. . . . July 19, 1865.
George H. Sayward . . . . . Winchester, Mass. . Oct. 29, 1890.
Arnold Schaer . . . . Agt. Warren Manufg. Co. . . . . Warren, R. I. . . . Apr. 24, 1895.
Albert E. Schofield . . Delph Spinning Co. . . . . Clearfield and C Sts., Philadelphia, Pa. . . Oct. 1, 1903.
Theodore C. Search . . Pres. Cold Spring Bleaching and Finishing Works . . . . . Yardley, Pa. . . . . Oct. 18, 1900.
Albion K. Searls . . . Supt. Yarn Dept., Oneita Knitting Mills . . . . . 241 South St., Utica, N. Y. . . . . Apr. 24, 1902.
Charles M. Sears . . . Supt. Harmony Grove Cotton Mills . Harmony Grove, Ga., Apr. 27, 1898.
George H. Shapley . . Treas. Silver Lake Co., 78 Chauncy St. . . . . Boston, Mass. . . . . Apr. 29, 1896.
Frank P. Sheldon . . . Mill Engineer and Architect, 49 Westminster St. . . . . Industrial Trust Bldg. Providence, R. I. . . Apr. 25, 1894.
Thomas C. Sheldon . . Agt. Fitchburg Duck Mills . . . . . 8 School St., Fitchburg, Mass. . . Oct. 29, 1884.
Willis S. Shepard . . . Pres. American Net and Twine Co. . Ponkapoag, Mass. . Apr. 29, 1896.
William F. Sherman . . Mill Engineer . . . . . 107 New Brazer Bldg., 27 State St., Boston, Mass. . . . Apr. 15, 1874.
Charles M. Shove . . . Treas. Granite Mills . . . Box 45, Fall River, Mass. . . Oct. 27, 1875.
Herbert H. Shumway . Treas. and Agt. Corr Manufg. Co. . Taunton, Mass. . . . Apr. 26, 1893.
Francis H. Silsbee . . Supt. Cotton Dept. Pacific Mills . . Lawrence, Mass. . . Apr. 27, 1887.

Nathaniel G. Simonds	Treas. Naumkeag Steam Cotton Co.	Salem, Mass.	Apr. 27, 1898.
Louis Simpson	Victoria Chambers,	Ottawa, Ont.	Apr. 24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills	863 High St., Fall River, Mass.	Oct. 25, 1893.
Arthur T. Smith	Supt. Langley Manufg Co. / Supt. Aiken Manufg. Co.	Langley, S. C.	Oct. 25, 1895.
James Herbert Smith	Supt. Quinebaug Co.	Danielson, Conn.	Apr. 27, 1898.
Joel Smith	Supt. The J. P. King Manufg. Co.	Augusta, Ga.	Oct. 25, 1895.
J. C. Smith	Supt. Chace Mills	Fall River, Mass.	Oct. 28, 1897.
Thomas Henry Smith	Jamestown Cotton Mill	Jamestown, N. Y.	Apr. 30, 1884.
William S. Southworth	Agt. Mass. Cotton Mills	Box 1230, Lowell, Mass.	Oct. 31, 1888.
Wilton H. Spencer	Textile Manuf.,	7 Exchange Pl., Providence, R. I.	Apr. 27, 1898.
George E. Spofford	Supt. Blackstone Mfg. Co.	Blackstone, Mass.	Apr. 29, 1896.
Henry B. Sprague	Treas. Boston Woven Hose and Rubber Co.	Lynn, Mass.	Oct. 5, 1899.
Leroy Springs	Pres. Lancaster Cotton Mills	Lancaster, S. C.	Oct. 25, 1895.
George R. Stearns	Pres. Riverside Mills	Augusta, Ga.	Apr. 30, 1890.
T. B. Stevenson	Supt. Manchang Co.	Manchang, Mass.	Apr. 26, 1900.
Robert Stewart	Asst. Supt. Lonsdale Co.	Ashton, R. I.	Apr. 27, 1899.
Samuel Stewart	Supt. Boston Duck Co.	Bondsville, Mass.	Apr. 23, 1903.
William J. Stewart	Supt. H. N. Slater Mills	Webster, Mass.	Apr. 23, 1903.
Walter F. Stiles	Treas. Orswell Mills	Fitchburg, Mass.	Oct. 25, 1895.
O. W. Stites	Elliott Fuel Saving Co.	Durham, N. C.	Oct. 25, 1895.
B. L. Stowe	Vice-Pres. Eureka Fire Hose Co.	Wilkinson and Arlington Aves., Jersey City, N. J.	Sept. 26, 1901.
Herman F. Straw	Agt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
John Sullivan	Supt. Union Cotton Mfg. Co.	Fall River, Mass.	Apr. 27, 1899.
Timothy Sullivan	Supt. Stafford Mills	Fall River, Mass.	Apr. 27, 1899.
Walter H. Summersby	Agt. Atlantic Cotton Mills	Lawrence, Mass.	Oct. 25, 1893.
D. G. Sunderland	Treas. The Pelham Mills	Pelham, S. C.	Oct. 18, 1900.
James O. Sweet	Agt. and Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.

Robert Rennie Taft		P. O. Box 1443, Providence, R. I.	Apr. 24, 1895.
Robert W. Taft	Treas. Coventry Co. and Bernon Mills	Box 1144, Providence, R. I.	Sept. 27, 1894.
George P. Taylor	Treas. Danielsonville Cotton Co. of Danielson, Conn.	286 Chestnut St., Clinton, Mass.	Oct. 27, 1880.
James W. Taylor	Agt. Canoe River Mills	Box 46, Taunton, Mass.	Oct. 26, 1892.
Samual Taylor	Supt. Soule Mill	New Bedford, Mass.	Oct. 1, 1903.
W. Marshall Taylor	Gen. Mgr. National Flax Fibre Co.	Box 327, Millis, Mass.	Sept. 22, 1896.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
S. Willard Thayer	Treas. Dexter Yarn Co.	Pawtucket, R. I.	Sept. 26, 1901.
Berton A. Thissell	Supt. Boott Cotton Mills	Lowell, Mass.	Oct. 1, 1903.
Earl A. Thissell	Treas. Lowell Hosiery Co.	Lowell, Mass.	Oct. 30, 1878.

Ariel C. Thomas	Agt. Boott Cotton Mills	62 Mt. Vernon St., Lowell, Mass.	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	44 Prospect St., Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Gen. Mgr. Richland, Granby & Olympia Mills	Columbia, S. C.	Apr. 30, 1884.
D. M. Thompson	Gen. Mgr. B. B. and R. Knight's Mills	Box 1442, Providence, R. I.	Oct. 28, 1885.
James O. Thompson, Jr.	Supt. Wamsutta Mills	New Bedford, Mass.	Oct. 18, 1900.
Ralph E. Thomson	Supt. Parkhill Manufg. Co., Mill C.	Fitchburg, Mass.	Apr. 25, 1894.
Joseph S. Tidd	Treas. Oakland Mills	Taunton, Mass.	Apr. 27, 1899.
Horace W. Tinkham	Treas. and Agt. Robeson Mills	Fall River, Mass.	Apr. 27, 1899.
R. Irving Tobey	Mgr. Cold Spring Bleaching and Finishing Works	Yardley, Pa.	Oct. 2, 1902.
W. O. Todd	Sec. and Treas. Lawton Spinning Co.	Box 1125, 621 Banigan Building, Providence, R. I.	Oct. 18, 1900.
James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
Daniel A. Tompkins	Pres. and Eng. D. A. Tompkins Co.	Charlotte, N. C.	Oct. 25, 1895.
M. J. Toohey	Mfr. Rope, Twine and Banding	809 Stafford Rd., Fall River, Mass	Oct. 2, 1902.
George W. Towne	Mgr. Columbus Power Co.	Columbus, Ga.	Oct. 26, 1892.
Edward B. Townsend,	Treas. Warwick Mills,	27 Kilby St., Boston, Mass.	Apr. 25, 1901.
D. Irving Trainer	Agt. Lincoln Mfg. Co.	Chester, Pa.	Apr. 23, 1903.
Robert B. Treat	Pres. and Treas. Mannfacturers Fuel Co. of Rhode Island	1032 Banigan Bldg., Providence, R. I.	Sept. 27, 1894.
C. H. Truesdell	Supt. Attawaugan Co.	Killingly, Conn.	Oct. 29, 1884.
Edmund E. Truesdell	Supt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell		18 Washington Terrace, Newtonville, Mass.	Oct. 15, 1873.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 25, 1895.
Philip S. Tuley	Pres. and Treas. Louisville Cotton Mills Co.	1008 Goss Ave., Louisville, Ky.	Oct. 18, 1900.
George W. Turner	Supt. Argo Mills Co.	Gloucester City, N. J.	Apr. 26, 1900.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Charles T. Upton		63 Mt. Vernon St., Lowell, Mass.	Apr. 28, 1897.
George A. Vaughan	Supt. The Putnam Manufg. Co.	Putnam, Conn.	Sept. 22, 1896.
William P. Vaughan	Agt. Putnam Manufacturing Co.	1041 Banigan Building, Providence, R. I.	Sept. 29, 1898.
Eugene F. Verdery	Pres. and Treas. Warren Mfg. Co.	739 Reynolds St., Augusta, Ga.	Apr. 26, 1900.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.

Jude C. Wadleigh . . . Supt. Mass. Cotton Mills . . . . . Lowell, Mass. . . . Oct. 26, 1892.
Herbert E. Walmsley . Agt. Wamsutta Mills . . . . . New Bedford, Mass. . Oct. 29, 1890.
Robinson Walmsley . . Supt. Tecumseh Mills, P. O. Box 246, Fall River, Mass. . . Apr. 27, 1899.
Frederick T. Walsh . . Mgr. Thomas Leyland & Co., Dyestuffs, etc. . . . . 195 Nesmith St., Lowell, Mass. . . . Apr. 28, 1897.
James A. Walsh . . . Agt. Lewiston Bleachery and Dye Works . . . . . Lewiston, Me. . . . Apr. 27, 1892.
Joseph Watters . . . . Supt. Osborn Mills . . . . . Fall River, Mass. . . Oct. 15, 1873.
F. E. Wattles . . . . Agt. Boscawen Mills . . . . . Penacook, N. H. . . Oct. 5, 1899.
Wm. T. Westerman . . Mgr. Ontario Spinning Co. . . . . 1729 Philip St., Philadelphia, Pa. . . Oct. 1, 1903.
W. B. Smith Whaley . Mechanical & Mill Engineer, Pres. Richland Cotton Mills, ... Granby Cotton Mills, 1012 Tremont Bldg., Boston, Mass, ... 1328 Main St., Columbia, S. C. . . Apr. 24, 1895.
H. D. Wheat . . . . . Pres. and Treas. Gaffney Mfg. Co. and Pres. and Treas. . . . . Orient Mfg. Co. . . . . Gaffney, S. C. . . . Apr. 24, 1895.
Channing Whitaker . . Infringement and Patentability of Inventions . . . . . Lowell Machine Shop . . . . . Lowell, Mass. . . . Oct. 15, 1873.
A. Tenny White . . . Supt. Manville Co. . . . . Manville, R. I. . . . Oct. 27, 1887.
Alphonso F. White . . Supt. Forestdale Mfg. Co., ... Forestdale, R. I. . . Apr. 24, 1902.
Charles D. White . . . Agt. Uncasville Mfg. Co. . . . . Norwich, Conn. . . . Oct. 28, 1897.
Arthur F. Whitin . . . Pres. Saunders Cotton Mills . . . . Whitinsville, Mass. . Apr. 24, 1895.
Fred B. Whitin . . . . Agt. Uxbridge Cotton Mills . . . . Linwood, Mass. . . Apr. 28, 1897.
Henry T. Whitin . . . Treas. Paul Whitin Manufg. Co. . . Northbridge, Mass. . Apr. 25, 1877.
James Earle Whitin . . Pres. Uxbridge Cotton Mills . . . . Whitinsville, Mass . . Apr. 23, 1903.
Paul Whitin . . . . . Asst. Treas. Paul Whitin Mfg. Co. . Northbridge, Mass. . Oct. 1, 1903.
Alfred N. Whiting . . Sec. and Treas. L. M. Harris Manufg. Co. . . . . 167 Pleasant St., Worcester, Mass. . . Apr. 21, 1875.
William Whitman . . Pres. Arlington Mills, 78 Chauncey St. . . . . P. O. Box 100, Essex St. Station, Boston, Mass. . . . . Apr. 25, 1901.
William S. Whitney . . Supervising Engineer, American Woolen Co. . . . . Lawrence, Mass. . . Apr. 24, 1878.
Arthur Whittam . . . Pres. and Mgr. John M. Stone Cotton Mills . . . . . Starkville, Miss., . . Apr. 27, 1898.
William Whittam, Jr. . Vice Pres. & Gen. Mgr. The William Whittam Textile Co. . . . . Ashville, N. C. . . . Apr. 26, 1893.
George F. Whitten . . Agt. Amory Mfg. Co. . . . . Manchester, N. H. . Oct. 26, 1892.
John H. Whitten . . . Agt. Stark Mills . . . . . Manchester, N. H. . Apr. 27, 1898.
W. R. B. Whittier . . Mgr. Whittier Mills . . . Chattahoochee, Fulton Co., Ga. . Oct. 18, 1900.
George A. Wies . . . . Treas. Eureka Fire Hose Co. . . . . 13 Barclay St., New York City . . . Apr. 24, 1902.
Edward B. Wilbur . . Gen. Mgr. & Supt. Mollohon Mfg. Co. Newberrry, S. C. . . . Oct. 30, 1889.
Benjamin Wilcox . . . Treas. City and Bristol Mfg. Co. . . New Bedford, Mass. . Apr. 26, 1900.
Henry M. Wilcox . . . Treas. John Rhodes Warp Co. . . . Millbury, Mass. . . . Apr. 24, 1889.
John B. Wild . . . . Pres. Oneita Knitting Mills . . . . Utica, N. Y. . . . . Apr. 26, 1900.
Eben C. Willey . . . . . 85 Pembroke St., Boston, Mass. . . . Apr. 29, 1896.
Franklin D. Williams . Treas. Fiskdale Mills, ... 87 Milk St., Room 21, Boston, Mass. . . . . Apr. 25, 1901.

Henry Williams . . . Supt. Canoe River Mill . . . . . Taunton, Mass. . . . Apr. 23, 1903.
Broadus E. Willingham, Sec. and Treas. Willingham Cotton Mills . . . . . Macon, Ga. . . . . Oct. 18, 1900.
Elias S. Willis . . . . Supt. Boott Cotton Mills . . . . Lowell, Mass. . . . Apr. 23, 1903.
Theop. W. Wilmarth . . . . . 79 Glenwood St., Malden, Mass. . . . Oct. 31, 1883.
William E. Winchester . Director Mississippi Textile School, Agricultural College, Miss. Apr. 24, 1902.
Samuel F. Winsper . . Supt. City Mfg. Co. . . . . New Bedford, Mass. . Apr. 23, 1903.
George Wood . . . . Pres. and Treas. Millville Manufg. Co. . . . . 626 Chestnut St., Phila., Pa. . . . . Oct. 16, 1872.
John P. Wood . . . . . 521 N. 22d St., Philadelphia, Pa. . . Apr. 28, 1897.
Oscar W. Wood . . . Treas. Germantown Spinning Co. . . . . Germantown, Philadelphia, Pa. . . Oct. 18, 1900.
C. J. H. Woodbury . . Secretary and Treasurer . . . . . 51 Baltimore St., Lynn, Mass. . . . . Oct. 29, 1879.
Wm. I. Woodward . . Agt. Shetucket Co., ... Norwich, Conn. . . Apr. 23, 1903.

Adelbert R. Young . . Supt. Ashland Cotton Co. . . . . Jewett City, Conn. . . Apr. 25, 1894.
James M. Young . . . Mgr. Hamilton Cotton Co. . . . . Hamilton, Ont., Can. Apr. 27, 1899.
Lewis J. Young . . . . Supt. Gault Mills of Montreal Cotton Co. . . . . Lock Box 240, Valleyfield, P. Q., Canada . . . . . Oct. 1, 1903.

ASSOCIATE MEMBERS.

S. B. Alexander, Jr. . . Pres. S. B. Alexander, Jr. Co. . . . Charlotte, N. C. . . . Oct. 18, 1900.
Eugene C. Andres . . Exporter and Importer . . . . . 517 John Hancock Building, Boston, Mass. . . . . Oct. 18, 1900.
Henry B. Ashton . . . Agt. S. A. Felton & Son Co. . . . . Manet Road, Newton Centre, Mass. Apr. 26, 1900.
Henry Ashworth . . . Agt. of Elijah Ashworth, Mfr. of Card Clothing . . . . . 89 Globe Mills Ave., Box 427, Fall River, Mass. . . Apr. 28, 1897.

George R. Babbitt . . . Pres. and Gen. Mgr. American Oil Co. and Pres. and Treas. The Burke Eng. Co., 182 So. Water St., Providence, R. I. . Apr. 24, 1895.
D. C. Ball . . . . . 5 Beekman St., New York, N. Y. . . Oct. 25, 1895.
Edwin Barnes . . . . Vice Pres. Wm. Firth Co. . . . . 67 Equitable Building, Boston, Mass. . . . . Apr. 26, 1900.
George S. Barnum . . Sec. and Treas. The Bigelow Co. . New Haven, Conn. . Apr. 24, 1895.
Colin C. Bell . . . . Vice-Pres. American Vulcanized Fibre Co. . . . . No. Cambridge, Mass. Apr. 29, 1896.
Frank P. Bennett . . . Publisher American Wool and Cotton Reporter . . . . . 530 Atlantic Ave., Boston, Mass. . . . Sept. 22, 1896.
William H. Bent . . . Treas. Mason Machine Works . . . Taunton, Mass. . . . April 29, 1896.
Edward H. Best . . . Woolen Merchant, 224 Purchase St., Boston, Mass. . . Apr. 23, 1903.
Albert Birch . . . . . Birch Bros. Co. . . . . Somerville, Mass. . . . Oct. 2, 1902.

F. H. Bishop . . . . . Gen. Mgr. Universal Winding Co. . . . . 95 South St., Boston, Mass. . . . . Apr. 26, 1900.

Edmund E. Blake . . Selling Agt. Saco & Pettee Machine Shops . . . . . Newton Upper Falls, Mass. Oct. 2, 1902.

Arthur T. Bradlee, . . Mgr. Cotton Yarn Dept., Harding, Whitman & Co. . . . . 78 Chauncy St., Boston, Mass. . . . . Apr. 25, 1901.

J. Payson Bradley . . . The Kehew-Bradley Co. . . . . 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.

J. Frank Braids . . Mgr. Grease & Oil Dept., Charles S. Bush Co. . . . . Box 20, 212 Weybosset St., Providence, R. I. . . Apr. 28, 1897.

Henry Gordon Brinckerhoff, N. E. Mgr. Green Fuel Economizer Co., Box 2654 . . . . . Room 1053, Exchange Bldg., 53 State St., Boston, Mass. Sept. 22, 1896.

H. Martin Brown . . . Treas. U. S. Bobbin & Shuttle Co. . Providence, R. I. . . Apr. 24, 1895.

George L. Brownell . . Inventor and Builder of Improved Twisting Machinery . . . . . Station A, Worcester, Mass. . . Apr. 23, 1903.

Percy H. Brundage . . . . . 49 Wall St., New York, N. Y. . . Oct. 5, 1899.

John H. Burghardt . . Page Belting Co. . . . 31 Pearl St., Boston, Mass. . . . Apr. 24, 1895.

Charles B. Burleigh . . Textile Power Dept., General Electric Co. . . . . 84 State St., Boston, Mass. . . Oct. 1, 1903.

Eugene E. Burnham . . Belt Mfr. . . . . 252 Lowell St., Lawrence, Mass. . . Oct. 25, 1895.

Fred N. Bushnell . . . Chief Engineer, Rhode Island Co. . Providence, R. I. . . Sept. 29, 1898.

Harry W. Butterworth . Sec. H. W. Butterworth & Sons . . . . . York and Cedar Sts., Philadelphia, Pa. . . Oct. 28, 1897.

James Butterworth . Pres. H. W. Butterworth & Sons . . . . . York and Cedar Sts., Philadelphia, Pa. . . Apr. 24, 1895.

French Campbell . . . Mgr. Yarn Dept., Care of James Freeman Brown Co. . . . . Box 132, New York, N. Y. . . Oct. 28, 1897.

Malcolm Campbell . . Gen. Mgr. Woonsocket Machine and Press Co. . . . . Woonsocket, R. I. . . Apr. 24, 1895.

W. W. Carey . . . . . Mfr. Wood Rim Pulleys and Wood Working Machinery . . . . . 514 Broadway, Lowell, Mass. . . . . Apr. 24, 1895.

Albert C. Case . . . . . 25 Broad St., Room 1213, New York, N. Y. . . Sept. 26, 1901.

J. E. Cheesman . . . . Pres. Cheesman Cotton Gin Co. . . . . 76 William St., New York, N. Y. . . Oct. 5, 1899.

Charles H. Child . . . Treas. Standard Mill Supply Co. . . . . P. O. Box 1426, 77 Exchange Place, Providence, R. I. . . Apr. 24, 1895.

Melvin H. Coffin . . . Selling Agt. Whitin Machine Works Whitinsville, Mass. . Oct. 2, 1902.

C. C. Cowan . . . . . 27 William St., New York, N. Y. . . Oct. 5, 1899.

Thomas G. Cox . . . . Selling Agt. Mason Machine Works . . . . . Box 316, Taunton, Mass. . . . Apr. 24, 1895.

C. F. Curwen . . . . Treas. Dinsmore Mfg. Co. . . . . Salem, Mass. . . . . Apr. 27, 1899.

Joseph L. Cushing . . Mfr. of Cotton Conveying Systems, Daniel Cushing & Co., ... Box 885, Lowell, Mass. . . . . Apr. 26, 1900.

Frederick I. Dana . . . Gen. Sales Mgr., The Textile Machinery Finishing Co. . . . . Providence, R. I. . . . Apr. 24, 1895.

Charles Henry Davis . C. E., Charles Henry Davis & Partners, ... 25 Broad St., New York, N. Y. . . Apr. 23, 1903.

Hugh De Haven . . Prop. De Haven Mfg. Co. . . . . 50-54 Columbia Heights, Brooklyn, N. Y. . . Apr. 23, 1903.

John O. DeWolf, . . . Mech. Engineer W. B. Smith Whaley & Co. . . . . 1012 Tremont Bldg., Boston, Mass. . . . Apr. 25, 1901.

C. E. W. Dow . . . . Selling Agt. American Moistening Co. . . . . 150 Devonshire St., Boston, Mass. . . . Apr. 24, 1895.

Frederick A. Downes . Pres. Keystone Mutual Fire Insurance Co. . . . . 925 Chestnut St., Philadelphia, Pa. . . Oct. 28, 1897.

W. L. Draper . . . . Mgr. Dodge Mfg. Co. . . . . Atlanta Branch, 507 Prudential Building, Atlanta, Ga. . . . . Oct. 18, 1900.

Fred W. Easton, . . . Treas. Easton & Burnham Machine Co., ... 180 Weeden St., Pawtucket, R. I. . . Apr. 25, 1901.

William Dresser Edwards B. F. Sturtevant Co. . . . . Jamaica Plain, Mass. Oct. 2, 1902.

G. B. Emmons . . . . Pres. Emmons Loom Harness Co. . . . . May St., Lawrence, Mass. . . Oct. 25, 1895.

John Henry English . English-Greene Co. 26 Fountain St., Providence, R. I. . . Oct. 1, 1903.

D. D. Felton . . . . . Treas. S. A. Felton & Son Co. . . . Manchester, N. H. . Apr. 24, 1895.

John W. Ferguson . . Contractor . . . . . Paterson Nat. Bank Bldg., Paterson, N. J. . . . Apr. 24, 1895.

L. L. Flemming . . . Vice-Pres. and Gen. Mgr. American Cotton Co. . . . . 25 Broad St., Lock Box 240, New York, N. Y. . . Apr. 23, 1903.

J. Herbert Foster . . . Cotton Broker . 10 South Water St., Providence, R. I. . . Apr. 24, 1895.

Merrill A. Furbush . . . . . 2015 North 33rd St., Philadelphia, Pa. . . Oct. 28, 1897.

John T. Fyans . . . . Agt. Fyans, Frazer & Blackway Co. . . . . 411 Beach St., Fall River, Mass. . . Apr. 28, 1897.

H. P. Garland . . . . Treas. Garland Mfg. Co. . . . . Saco, Me. . . . . Oct. 25, 1895.

Royal W. Gates . . . . Josiah Gates & Sons, Belting . . . . . 367 Market St., Lowell, Mass. . . . Apr. 24, 1895.

Vladimir F. Gnesin . . Sole Agt. of The Great Yaroslavl Mfg. Co. of Moscow, Russia . . . . . 68 Broad St., New York City . . . Oct. 1, 1903.

Rufus B. Goff . . . . Pres. Standard Mill Supply Co. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.

Henry T. Grant . . . Pres. Mercantile Mutual Fire Ins. Co. . . . . Box 1153, 723 Banigan Building, Providence, R. I. . . Oct. 28, 1897.

Arthur F. Gray . . . . Architect and Mill Engineer . . . . . 53 State St., Room 509, Boston, Mass. . . . Oct. 18, 1900.

Samuel M. Green, M. E. The American Thread Co. . . . . Holyoke, Mass. . . . Apr. 24, 1902..

Edwin Farnham Greene Pres. Lockwood, Greene & Co. . . . . 93 Federal St., Boston, Mass. . . . Apr. 24, 1902.

A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . 326 So. Water St., Providence, R. I. . . Oct. 25, 1895.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . Box 409, Fall River, Mass. . . . Oct. 28, 1897.
Charles C. Hedrick . . Mech. Eng. Lowell Machine Shop . Lowell, Mass. . . . Apr. 23, 1903.
Jerome Hill . . . . . Pres. Jerome Hill Cotton Co. . . . . 334 Front St., Memphis, Tenn. . . . Apr. 29, 1896.
Richard H. Hill . . . Gen. Sales Agt. James Hunter Machine Co. . . . . 70 Kilby St., Boston, Mass. . . . . Apr. 26, 1900.
Alfred K. Hobbs . . . Rubber, Leather and Mill Supplies . Manchester, N. H. . Oct. 18, 1900.
John Hogg . . . . . Smith, Hogg & Gardiner, 144 Essex St., Boston, Mass. . . . Apr. 27, 1899.
Henry A. Holcomb . . . . . Box 249, New Bedford, Mass. . Oct. 25, 1895.
Henry S. Houghton, Sr., Mfr. Grids and Beaters, 61 Pond St., Woonsocket, R. I. . Apr. 28, 1897.
Lewis T. Houghton . . Mfr. Appliances for Cotton Machinery . . . . . 997 Main St., Worcester, Mass. . . Sept. 26, 1901.
A. H. Howard . . . . Pres. and Treas. Howard Bros. Mfg. Co. . . . . P. O. Box 54, Worcester, Mass. . . Sept. 26, 1901.
Frederic W. Howe . . Salesman Crompton & Knowles Loom Works . . . . . 241 Harris Ave., Box 899, Providence, R. I. . . Apr. 24, 1902.
Lemuel R. Howe . . . Importer & Dealer in Dye Stuffs, Howe, Fuller & Trunkett, ... 157 Federal St., Boston, Mass. . . . Apr. 25, 1901.
C. H. Hutchins . . . . Pres. Crompton & Knowles Loom Works . . . . . Worcester, Mass. . . Oct. 25, 1895.

Daniel Jackson . . . . Cotton Buyer B. B. and R. Knight, . Providence, R. I. . . Apr. 24, 1902.
David Jackson . . . . Gen. Mgr. Jackson Pat. Shell Roll Co., Pawtucket, R. I. . . Apr. 24, 1895.

Lawrence M. Keeler . Whitin Machine Works . . . . . Whitinsville, Mass. . Sept. 26, 1901.
William B. Kehew . . The Kehew-Bradley Co., ... 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.
James H. Kendall . . Edward Kendall & Sons . . . . . Cambridgeport, Mass., Sept. 29, 1898.
John E. Kendrick . . . Pres. American Supply Co., Box 822, Providence, R. I. . . Oct. 5, 1899.
Frank B. Kenney . . . Mgr. Care of T. C. Entwistle Co. . . . . 297 Market St., Lowell, Mass. . . . Oct. 5, 1899.
Joseph C. King . . . . Ring Traveler . . . 133 Essex St., Boston, Mass. . . . Oct. 1, 1903.

W. C. Langford . . . Salesman, . . . 86 Weybosset St., Providence, R. I. . . Apr. 27, 1899.
Josiah M. Lasell . . . Asst. Treas. Whitin Machine Works, Whitinsville, Mass. . Apr. 24, 1895.
Samuel D. Lawton . . Treas. Fall River Machine Co. . . . Fall River, Mass. . . Oct. 18, 1900.
John H. Lorimer . . . Builder of Textile Machines . . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 28, 1897.
Sanford E. Loring . . Con. Architect, 341 Delaware St., . Syracuse, N. Y. . . Apr. 24, 1902.
Stephen C. Lowe . . . Agt. John Hetherington & Sons, Ltd., ... 186 Devonshire St., Boston, Mass. . . . Oct. 25, 1895.

Francis E. Macomber	Mill Supplies	21 Pearl St., Boston, Mass.	Apr. 26, 1900.
Fay H. Martin	Pres. Textile Machinery Co.	50 State St., Boston, Mass.	Sept. 26, 1901.
F. H. Maynard	Gen. Bus. Mgr. Gen. Fire Extinguisher Co.	Providence, R. I.	Apr. 24, 1895.
John McCullough,	Cotton Waste Merchant	New Bedford, Mass.	April 25, 1901.
D. E. McGaw	Gen. Mgr. Aragon Mills	Aragon, Ga.	Oct. 18, 1900.
H. G. McKerrow	Textile Machinery Importer	31 State St., Boston, Mass.	Sept. 22, 1896.
D. K. McLaren	Mfr. of Leather Belting	751 Craig St., Montreal, P. Q., Can.	Apr. 26, 1900.
John R. Mitchell	Mitchell-Bissell Co.	38 Murray St., New York City	Oct. 18, 1900.
Charles B. Moore	Mgr. Knowles Steam Pump Works	54 Oliver St., Boston, Mass.	Apr. 26, 1900.
Robert W. Neff	Chemical Mfr.	22 India Sq., Boston, Mass.	Apr. 24, 1902.
John H. Nelson	Treas. William Firth Co.	60 Baltimore St., Lynn, Mass.	Apr. 26, 1900.
William R. Noone		102 South St., Boston, Mass.	Oct. 28, 1897.
Sidney B. Paine	General Electric Co.	84 State St., Boston, Mass.	Apr. 24, 1895.
William F. Parish, Jr.	Chief, Vacuum Oil Co. (Technical Department)	York House, Norfolk St., London, W. C., England,	Apr. 24, 1902.
Arthur Parkinson	Selling Agt. Arabol Mfg. Co.	13 Gold St., New York, N. Y.	Apr. 28, 1897.
Stephen Minot Pitman	Sec'y Narragansett Mutual Fire Insurance Co.	721 Banigan Bldg., Box 315, Providence, R. I.	Apr. 24, 1895.
Vladimir P. Polevoy		120 Broadway, N. Y.	Apr. 28, 1897.
Charles A. M. Praray	Chas. A. M. Praray & Co., Architect and Mill Engineer	832 and 833 Banigan Building, Providence, R. I.	Apr. 28, 1897.
Theodore H. Price	Cotton Dealer	71 Wall St., New York, N. Y.	Oct. 2, 1902.
Charles F. Randall	Expert in Textiles	Room 350, Tremont Building, Boston, Mass.	Apr. 24, 1895.
Peleg A. Rhodes	Sec. Cotton Mill Mutual Fire Insurance Co.	Augusta, Ga.	Oct. 5, 1899.
Richard H. Rice	Treas. Providence Engineering Works	521 So. Main St., Providence, R. I.	Apr. 24, 1895
E. R. Richardson	Asst. Treas. Howard & Bullough American Machine Co., Ltd.	Box 678, Pawtucket, R. I.	Apr. 26, 1900.
C. E. Roberts	Mgr. Hartford Steam Boiler Inspection & Insurance Co.	101 Milk St., Room 400, Boston, Mass.	Apr. 24, 1895.
George I. Rockwood,	Mechanical Engineer,	62 Summer St., Worcester, Mass.	Apr. 25, 1901.
John M. Russell	Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 25, 1895.

Dwight Seabury	Mill Engineer	12 East Ave., Pawtucket, R. I.	Apr. 25, 1901.
William N. Shaw	Treas. The Lincoln Iron Works and Jackson Architectural Iron Works	315 E. 28th St., New York, N. Y.	Apr. 24, 1902.
J. A. Shepherd	Sales Agt. The Stirling Co.	Germania Building, Pittsburg, Pa.	Oct. 18, 1900.
Harry M. Smith	Vice-Pres. Standard Mill Supply Co.	77 Exchange Pl., Box 714, Providence, R. I.	Apr. 28, 1897.
R. Paul Snelling	Treas. Saco and Pettee Machine Shops	Newton Upper Falls, Mass.	Sept. 22, 1896.
Henry C. Spence	Gen. Mgr. Metallic Drawing Roll Co.	Indian Orchard, Mass.	Apr. 24, 1895.
George W. Stafford	Pres. and Gen. Mgr. Geo. W. Stafford Co.	Readville, Mass.	Apr. 24, 1895.
H. E. Stafford	Agt. Geo. W. Stafford Co.	Readville, Mass.	Oct. 18, 1900.
James Strang	Selling Agt. Metallic Drawing Roll Co.	123 Hampden St., Indian Orchard, Mass.	Oct. 28, 1897.
Daniel J. Sully	Cotton Broker, T. M. Reynolds & Co.,	34 South Water St., Providence, R. I.	Apr. 24, 1895.
John Sykes, J. P.	Pres. English Card Clothing Co.	Acre House, Huddersfield, Eng.	Oct. 18, 1900.
Cyrus A. Taft	Agt. Whitin Machine Works	Whitinsville, Mass.	Apr. 24, 1895.
Charles F. Taylor	Prop. Burgess Cop Tube Co.,	15 Custom House St., Providence, R. I.	Apr. 27, 1898.
Elwood E. Taylor	N. E. Mgr. Under-Feed Stoker Co.	430 Board of Trade Building, Boston, Mass.	Apr. 23, 1903.
George C. Tewksbury	N. E. Mgr. The Under-Feed Stoker Co. of America	429-430 Board of Trade Bldg., 131 State St., Boston, Mass.	Apr. 24, 1902.
James T. Thornton	Treas. Thornton Machinery Co.	Providence, R. I.	Oct. 18, 1900.
William V. Threlfall	Agt. Saco and Pettee Machine Shops,	Biddeford, Me.	Apr. 24, 1895.
Rienzi W. Thurston	Machinery Manufacturer	Fall River, Mass.	Oct. 18, 1900.
H. A. Tillinghast,	Treas. The Textile Finishing Mach. Co.	Providence, R. I.	Apr. 25, 1901.
A. Curtis Tingley	Treas. National Ring Traveler Co.	257 West Exchange St., Providence, R. I.	Sept. 22, 1896.
Allison W. Trafford	Mfr. of Ring Travelers	116 Pocasset St., Fall River, Mass.	Apr. 26, 1900.
Frank H. Underwood	Resident Mgr. Dodge Mfg. Co.	137 Purchase St., Boston, Mass.	Apr. 29, 1896.
Clement A. Wakefield	Selling Agt. Saco & Pettee Machine Shops,	38 South St., Biddeford, Me.	Apr. 25, 1901.
Justin A. Ware		Spring Hill, Barnstable County, Mass.	Oct. 25, 1895.
J. F. Warren	Treas. J. F. & W. H. Warren Co.	44 Vine St., Worcester, Mass.	Apr. 24, 1902.

Lettice R. Washburn	Mill Contractor, 235 North Water St., New Bedford, Mass.	Oct.	5, 1899.
George H. Watson	Pres. The Northern Engineering Co. 95 Liberty St., New York, N. Y.	Apr.	23, 1903.
Walter S. Watson	Haworth & Watson, Mfrs. Paper Tubes for Textile Manufg. Box 996, Lowell, Mass.	Oct.	25, 1895.
Robert C. Webster	Mgr. Barber & Colman 11 Pemberton Sq., Rooms 1111-12, Boston, Mass.	Apr.	24, 1902.
Stephen M. Weld,	Stephen M. Weld & Co., 89 State St., Boston, Mass.	Apr.	27, 1899.
William R. West	Roll Coverer 830 Purchase St., New Bedford, Mass.	Sept.	22, 1896.
W. W. White	Agent Holyoke Machine Co. Worcester, Mass.	Apr.	27, 1899.
G. Marston Whitin	Treas. Whitin Machine Works Whitinsville, Mass.	Apr.	24, 1895.
Fred A. Wilde	Gen. Mgr. The A. T. Atherton Machine Co. Prairie Ave., Pawtucket, R. I.	Apr.	28, 1897.
Erving Yale Woolley	Stoddard, Haserick, Richards & Co. 152 Congress St., Boston, Mass.	Apr.	24, 1895.

Honorary Members	3
Active Members	567
Associate Members	153
Total Membership	723

MEMBERS OF THE ASSOCIATION,

May 1, 1903.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Biddeford	Robert McArthur	Pepperell Mfg. Co.
Biddeford	William V. Threlfall	Saco & Pettee Machine Shops.
Biddeford	Clement A. Wakefield	Saco & Pettee Machine Shops.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lisbon	Nathaniel F. Ayer	Farwell Mills.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works
Lisbon	W. H. Miles	
Portland	Lyman M. Cousens	Dana Warp Mills.
Saco	H. P. Garland	Garland Mfg. Co.
Saco	James G. Garland	Garland Mfg. Co.
Saco	Elmer E. Page	York Manufg. Co.
Sanford	Louis B. Goodall	Goodall Worsted Co.
Westbrook	Philip Dana	Dana Warp Mills.
Westbrook	Woodbury K. Dana	Dana Warp Mills.

NEW HAMPSHIRE.

Charlestown	Samuel Webber	Hydraulic Engineer.
Claremont	Frank P. Vogl	Monadnock Mills.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	George A. Hurd	76 Broadway.

Dover	Herbert W. Owen	Cocheco Manufg. Co.
Exeter	George E. Kent	Exeter Manufg. Co.
Exeter	Hervey Kent	Exeter Manufg. Co.
Greenville	Frederick W. Ely	Columbian Manufg. Co.
Hooksett	Stephen N. Bourne	Dundee Mills.
Manchester	Henry Deane Bourne	Hooksett Manufg. Co.
Manchester	D. D. Felton	S. A. Felton & Son Co.
Manchester	Alfred K. Hobbs	Rubber, Leather and Mill Supplies.
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	John K. Russell	476 Hall St.
Manchester	Herman F. Straw	Amoskeag Manufg. Co.
Manchester	George F. Whitten	Amory Manufg. Co.
Manchester	John H. Whitten	Stark Mills.
Milford	M. F. Foster	
Nashua	William F. Arthur	Nashua Manufacturing Co.
Nashua	William H. Cadwell	Jackson Co.
Nashua	Roscoe S. Milliken	Nashua Mfg. Co.
Newmarket	John L. Burton	Newmarket Mfg. Co.
Penacook	Marcellus Gould	N. H. Spinning Mills.
Penacook	F. E. Wattles	Boscawen Mills.
Peterboro	Albert W. Noone	Jos. Noone's Son's Co.
Salmon Falls	O. S. Brown	Salmon Falls Manufg. Co.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

North Pownal	Thomas Armstrong	North Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Z. D. Hall	Berkshire Cotton Manufg. Co.
Adams	Emil Kipper	Renfrew Mfg. Co. and Windsor Print Works.
Adams	Charles T. Plunkett	Berkshire Cotton Manufg. Co.
Adams	William C. Plunkett,	W. C. Plunkett & Sons.
Adams	L. B. Renfrew	Renfrew Mfg. Co.
Amesbury	M. W. Quinn	Hamilton Woolen Co.
Andover	John W. Bell	Smith & Dove Manufg. Co.
Belmont	John Kilburn	
Blackstone	George E. Spofford	Blackstone Manufg. Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Bondsville	Samuel Stewart	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Mfg. Co.

Boston	Frederic Amory	Nashua Mfg.Co. and Jackson Mfg.Co.
Boston	Eugene C. Andres	517 John Hancock Builindg.
Boston	Edward Atkinson	Boston Mfrs. Mut. Fire Ins. Co.
Boston	E. W. Atkinson	Stoddard, Haserick, Richards & Co.
Boston	Edwin Barnes	Wm. Firth Co.
Boston	Albert Farewell Bemis	Jackson Fibre Co.
Boston	Frank P. Bennett	Am. Wool and Cotton Reporter.
Boston	Edward H. Best	Woolen Merchant.
Boston	F. H. Bishop	Universal Winding Co.
Boston	Arthur T. Bradlee	Harding, Whitman & Co.
Boston	J. Payson Bradley	The Kehew-Bradley Co.
Boston	S. Parker Bremer	Monadnock Mills.
Boston	Henry Gordon Brinckerhoff	Green Fuel Economizer Co.
Boston	John H. Burghardt	Page Belting Co.
Boston	Charles B. Burleigh	General Electric Co.
Boston	Frank B. Comins	American Moistening Co.
Boston	Alphonse S. Covel	Tremont and Suffolk Mills.
Boston	Augustus De Cort	Beacon Mfg. Co.
Boston	P. Y. DeNormandie	Pepperell Mfg. Co.
Boston	John O. DeWolf	W. B. Smith Whaley & Co.
Boston	C. E. W. Dow	150 Devonshire St.
Boston	Frederic C. Dumaine	Amory Mfg. Co.
Boston	William Firth	Am. Moist. Co. and Wm. Firth Co.
Boston	Alfred M. Goodale	Boston Mfg. Co.
Boston	Arthur F. Gray	53 State St., Room 509.
Boston	Edwin Farnham Greene	Lockwood, Greene & Co.
Boston	Richard H. Hill	Jas. Hunter Machine Co.
Boston	William H. Hill	Windsor Co. and Renfrew Mfg. Co.
Boston	Franklin W. Hobbs	Arlington Mills.
Boston	John Hogg	Smith, Hogg & Gardiner.
Boston	Henry S. Howe	Dry Goods Commission.
Boston	Lemuel R. Howe	Howe, Fuller & Trunkett.
Boston	Charles W. Hubbard	Ludlow Mfg. Associates.
Boston	Joseph B. Jamieson	New England Cotton Yarn Co.
Boston	William B. Kehew	The Kehew-Bradley Co.
Boston	Joseph C. King	Morley Button Mfg. Co.
Boston	Evan Arthur Leigh	70 Kilby St.
Boston	William C. Lovering	Whittenton Mfg. Co.
Boston	Stephen C. Lowe	John Hetherington & Sons, Ltd.
Boston	A. Lawrence Lowell	53 State St.
Boston	Herbert Lyman	39 Beacon St.
Boston	Ronald T. Lyman	Boston Mfg. Co.
Boston	Francis E. Macomber	21 Pearl St.
Boston	Charles T. Main	Dean & Main.
Boston	Fay H. Martin	Textile Machinery Co.
Boston	Fred C. McDuffie	Everett Mills and York Mfg. Co.
Boston	H. G. McKerrow	31 State St.

Boston	Charles B. Moore	Knowles Steam Pump Works.
Boston	George B. Morison	Ballou Yarn Co.
Boston	Robert W. Neff	Chemical Mfr.
Boston	William R. Noone	102 South St.
Boston	Sidney B. Paine	General Electric Co.
Boston	Benjamin Phipps	4 Winthrop Sq.
Boston	Henry Smith Pritchett, LL.D.	Mass. Institute of Technology.
Boston	Charles F. Randall	350 Tremont Building.
Boston	Charles E. Riley	C. E. Riley & Co.
Boston	C. E. Roberts	Hartford Steam Boiler Insp. & Ins.Co
Boston	Arnold B. Sanford	Kennebec Spinning Mills.
Boston	J. Herbert Sawyer	93 Federal St.
Boston	George H. Shapley	Silver Lake Co.
Boston	William F. Sherman	27 State St.
Boston	Elwood E. Taylor	Under-Feed Stoker Co.
Boston	George C. Tewksbury	The Under-Feed Stoker Co. of America.
Boston	James P. Tolman	Samson Cordage Works.
Boston	Edward B. Townsend	Warwick Mills.
Boston	Frank H. Underwood	Dodge Mfg. Co.
Boston	Robert C. Webster	Barber & Colman.
Boston	Stephen M. Weld	89 State St.
Boston	William Whitman	Arlington Mills.
Boston	Eben C. Willey	85 Pembroke St
Boston	Franklin D. Williams	Fiskdale Mills.
Boston	Erving Yale Woolley	Stoddard Haserick, Richards & Co.
Cambridgeport	James H. Kendall	Edward Kendall & Sons.
Chicopee Falls	G. H. T. Babbitt	Chicopee Mfg. Co.
Clinton	William G. McLoon	Lancaster Mills.
Clinton	Charles H. Richardson	Lancaster Mills.
Clinton	George P. Taylor	Danielsonville Cotton Co.
East Dedham	Benjamin M. Earl	Merchant Dye Works.
Easthampton	George A. Ayer	West Boylston Co.
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Agt. for Card Clothing Manufr.
Fall River	J. W. Bailey	Principal, The Bradford Durfee Textile School.
Fall River	John P. Bodge	Arkwright Mills.
Fall River	Jefferson Borden, Jr.	Fall River Bleachery Co.
Fall River	Nathaniel B. Borden	Barnard Manufg. Co.
Fall River	Richard B. Borden	Richard Borden Mfg. Co.
Fall River	Isaac A. Brown	Narragansett Mills.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Philip Mills.
Fall River	John A. Collins	American Linen Co.
Fall River	Bradford D. Davol	Barnard Manufg. Co.
Fall River	Frank H. Dwelly	Tecumseh Mills.

Fall River	David H. Dyer	D. H. Dyer & Son.
Fall River	John H. Estes	Cotton Manufacturer.
Fall River	William Evans	Wampanoag Mills.
Fall River	Charles F. Farrar	22 Coggeshall St.
Fall River	John T. Fyans	Fyans, Frazer & Blackway Co.
Fall River	Arthur M. Hamilton	Hargraves and Parker Mills.
Fall River	John F. Hamlet	P. O. Box 160
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	Samuel E. Hathaway	Fall River Iron Works Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	Yarn Broker.
Fall River	George H. Hills	Davol Mills and Stevens Mfg. Co.
Fall River	William P. Holt	Barnaby Mills.
Fall River	Leonard Johnson	Wampanoag Mills.
Fall River	George H. Law	Merchants' Mfg. Co.
Fall River	Samuel D. Lawton	Fall River Machine Co.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	Alexander Makepeace	Richard Borden Mfg. Co.
Fall River	Henry D. Martin	Stevens Mfg. Co.
Fall River	Arthur H. Mason	Barnaby Mfg. Co.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	Thomas McAuliffe	Stevens Manufg. Co.
Fall River	James A. McLane	Davis Mills.
Fall River	J. Edward Osborn	American Linen Co.
Fall River	Joseph H. Potter, Jr.	Durfee Mills.
Fall River	John Bion Richards	Davis Mills.
Fall River	Benj. H. Roberts	163 Grove St.
Fall River	Charles M. Shove	Granite Mills.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	J. C. Smith	Chace Mills.
Fall River	John Sullivan	Union Cotton Manufg. Co.
Fall River	Timothy Sullivan	Stafford Mills.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	Rienzi W. Thurston	Machinery Manufacturer.
Fall River	Horace W. Tinkham	Robeson Mills.
Fall River	M. J. Toohey	Mfr. Rope, Twine and Banding.
Fall River	Allison W. Trafford	Mfr. Ring Travelers.
Fall River	Robinson Walmsley	Tecumseh Mills.
Fall River	Joseph Watters	Osborn Mills.
Fisherville	Albert W. Dimick	Fisher Mfg. Co.
Fisherville	Charles W. Fisher	Fisher Mfg. Co.
Fiskdale	John Gregson	Fiskdale Mills.
Fitchburg	Ernest L. Hersom	Nockege Mill.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	Grant Yarn Co.
Fitchburg	John Leiper	Fitchburg Worsted Mills.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.

Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Orswell Mills.
Fitchburg	Ralph E. Thomson	Parkhill Manufg. Co., Mill C.
Holyoke	Samuel M. Green	The American Thread Co.
Holyoke	Ernest Lovering	Lyman Mills.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Draper Co.
Hopedale	William F. Draper	Draper Co.
Hopedale	William F. Draper, Jr.	Draper Co.
Hopedale	Frank J. Dutcher	Draper Co.
Housatonic	Jno. H. C. Church	Monument Mills.
Housatonic	Theodore Ellis Ramsdell	Monument Mills.
Hyde Park	Calvin H. Lee	Readville Cotton Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	James Strang	Metallic Drawing Roll Co.
Ipswich	James W. Brown	Box 312.
Jamaica Plain	William Dresser Edwards	B. F. Sturtevant Co.
Lawrence	William A. Barrell	Lawrence Duck Co.
Lawrence	Albert W. Brainard	Box 33.
Lawrence	Eugene E. Burnham	252 Lowell St.
Lawrence	G. B. Emmons	Emmons Loom Harness Co.
Lawrence	William D. Hartshorne	Arlington Mills.
Lawrence	Walter M. Hastings	Arlington Mills.
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	Box 28.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	Walter H. Summersby	Atlantic Cotton Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	American Woolen Co.
Leicester	Charles A. Denny	
Linwood	Amos G. Maddox	Linwood Mill.
Linwood	Fred B. Whitin	
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Wood Rim Pulleys and Wood Working Machinery.
Lowell	Clarence N. Childs	Hamilton Mfg. Co.
Lowell	John J. Connell	Tremont and Suffolk Mills.
Lowell	A. G. Cumnock	Appleton Co.
Lowell	Joseph L. Cushing	Daniel Cushing & Co.
Lowell	Albert W. Danforth	Shanghai Cotton Cloth Mills.
Lowell	Albert Deabill	Lowell Hosiery Co.

Lowell	Edward P. Dennis	Lowell Machine Shop.
Lowell	John H. Dunn	Tremont & Suffolk Mills.
Lowell	William Ambrose Eastman	Hooper Knitting Co.
Lowell	Royal W. Gates	Josiah Gates & Sons.
Lowell	William E. Hall	Shaw Stocking Co.
Lowell	Charles C. Hedrick	Lowell Machine Shop.
Lowell	Otis L. Humphrey	Cotton Dept. Lowell Textile School.
Lowell	A. W. Hunking,	374 Stevens St.
Lowell	Frank B. Kenney	T. C. Entwistle Co.
Lowell	Charles F. Libby	Shaw Stocking Co.
Lowell	Alvin S. Lyon	Bigelow Co.
Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Will Nelson	Lowell Textile School.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimack Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	Tremont & Suffolk Mills.
Lowell	Edwin A. Robinson	Tremont and Suffolk Mills.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	Berton A. Thissell	Boott Cotton Mills.
Lowell	Earl A. Thissell	Lowell Hosiery Co.
Lowell	Ariel C. Thomas	Boott Cotton Mills.
Lowell	Charles T. Upton	63 Mt. Vernon St.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Frederick T. Walsh	Thomas Leyland & Co.
Lowell	Walter S. Watson	Haworth & Watson.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lowell	Elias S. Willis	Boott Cotton Mills.
Lynn	John H. Nelson	Wm. Firth Co.
Lynn	Henry B. Sprague	Boston Woven Hose and Rubber Co
Lynn	C. J. H. Woodbury	51 Baltimore St.
Malden	Theop. W. Wilmarth	79 Glenwood St.
Manchang	T. B. Stevenson	Manchang Co.
Methuen	Lewis E. Barnes	Pemberton Co. and Methuen Co.
Methuen	Alfred Sagar	Arlington Cotton Mills.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Francis H. Rice	Holbrook Mfg. Co.
Millbury	Henry M. Wilcox	John Rhodes Warp Co.
Millis	W. Marshall Taylor	National Flax Fibre Co.
New Bedford	Christopher P. Brooks	New Bedford Textile School.
New Bedford	Richard Cowell	290 Summer St.
New Bedford	William W. Crapo	Wamsutta Mills.
New Bedford	Mark B. Creed	Wamsutta Mills.
New Bedford	Frederick Grinnell	Gen. Fire Extinguisher Co.
New Bedford	Hiram Higham	Wamsutta Mills.
New Bedford	Henry A. Holcomb	Box 249.

New Bedford	Nathaniel B. Kerr	Butler Mill.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	Frederick B. Macy	Soule Mills.
New Bedford	John McCullough	Cotton Waste Merchant.
New Bedford	John Neild	Grinnell Mfg. Corp.
New Bedford	Walter H Paige	Wamsutta Mills.
New Bedford	Albert R. Pierce	Pierce Mfg. Corp.
New Bedford	Andrew G. Pierce, Jr.	Pierce Mfg. Corp.
New Bedford	Lavater W. Powers	141 Merrimac St.
New Bedford	Frederick W. Reynolds	Potomska Mills.
New Bedford	Samuel Taylor	Soule Mill.
New Bedford	James O. Thompson, Jr.	Wamsutta Mills.
New Bedford	Herbert E. Walmsley	Wamsutta Mills.
New Bedford	Lettice R. Washburn	235 North Water St.
New Bedford	William R. West	830 Purchase St.
New Bedford	Benjamin Wilcox	City and Bristol Mfg. Co.
Newburyport	O. D. Drew	Peabody Mfg. Co.
New Bedford	Samuel F. Winsper	City Mfg Co.
Newton	Josiah G. Coburn	99 Washington St.
Newton Centre	Henry B. Ashton	S. A. Felton & Son Co.
Newtonville	Oscar B. Truesdell	18 Washington Terrace.
Newton Upper Falls	Edmund E. Blake	Saco & Pettee Machine Shops.
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. Paul Snelling	Saco and Pettee Machine Shops.
North Adams	Hervey Burnham	Beaver Mills and Eclipse Mill.
North Adams	Charles W. Dennett	Johnson-Dunbar Mills Co.
Northbridge	Henry S. Houghton, Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
Northbridge	Paul Whitin	Paul Whitin Mfg. Co.
North Cambridge	Colin C. Bell	American Vulcanized Fibre Co.
Northampton	Charles E. Childs,	West Boylston Co.
North Oxford	Edwin N. Bartlett	Sigourney and Rockdale Mills.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
Ponkapoag	Willis S. Shepard	American Net & Twine Co.
Readville	George W. Stafford	George W. Stafford Co.
Readville	H. E. Stafford	George W. Stafford Co.
Salem	C. F. Curwen	Dinsmore Mfg. Co.
Salem	William P. McMullan	Naumkeag Steam Cotton Co.
Salem	Henry Osgood	P. O. Box 204.
Salem	Nathaniel G. Simonds	Naumkeag Steam Cotton Co.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
Somerville	Albert Birch	Birch Bros. Co.
Springfield	Joseph M. Dunham	43 Edwards St.
Spring Hill	Justin A. Ware	
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	William H. Bent	Mason Machine Works.
Taunton	Peter H. Corr	Greenwich Bleachery.

Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	H. H. Culver	Elizabeth Poole Mills.
Taunton	Henry S. Culver	Westville Cotton Mills.
Taunton	Andrew J. Currier	New England Cotton Yarn Co.
Taunton	Herbert Fisher	
Taunton	Jesse A. Knight	Cohannet Mills.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	William M. Lovering	Whittenton Manufg. Co.
Taunton	Charles L. Macomber	Winthrop Cotton Yarn Co.
Taunton	John Tempest Meats	Mason Machine Works.
Taunton	Herbert H. Shumway	Corr Manufg. Co.
Taunton	James W. Taylor	Canoe River Mills.
Taunton	Joseph S. Tidd	Oakland Mills.
Taunton	Henry Williams	Canoe River Mill.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mill.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles E. Getchell	Waltham Emery Wheel. Co
Waltham	Arthur H. Gulliver	Boston Mfg. Co.
Ware	George E. Tucker	The Otis Co.
Webster	E. P. Morton	Stevens Linen Works.
Webster	William J. Stewart	H. N. Slater Mills.
West Warren	A. G. Harris	
West Warren	George A. Moody	West Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Whitinsville Cotton Mills and Linwood Mills.
Whitinsville	Melvin H. Coffin	Whitin Machine Works.
Whitinsville	Lawrence M. Keeler	Whitin Machine Works.
Whitinsville	Josiah M. Lasell	Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Cyrus A. Taft	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Saunders Cotton Mills.
Whitinsville	G. Marston Whitin	Whitin Machine Works.
Whitinsville	James Earle Whitin	Uxbridge Cotton Mills.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Winchester	George H. Sayward	
Worcester	Joseph P. Battles	10 Hammond St.
Worcester	George L. Brownell	Inventor and Builder of Improved Twisting Machinery Station A.
Worcester	Henry F. Harris	W. Boylston Mfg. Co.
Worcester	Lewis T. Houghton	997 Main St.
Worcester	A. H. Howard	Howard Bros. Mfg. Co.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	Geo. E. Prest	104 Harrison St.
Worcester	Harry B. Prest	104 Harrison St.
Worcester	John E. Prest	104 Harrison St.
Worcester	Geo. I. Rockwood	62 Summer St.

Worcester	John M. Russell	Crompton & Knowles Loom Works.
Worcester	J. F. Warren	J. F. & W. H. Warren Co.
Worcester	W. W. White	Holyoke Machine Co.
Worcester	Alfred N. Whiting	L. M. Harris Mfg. Co.

RHODE ISLAND.

Allenton	R. A. Gray	Rodman Manufg. Co.
Ashton	Charles H. Collins	Berkeley Co.
Ashton	Robert Stewart	Lonsdale Co.
Bayside	Abel T. Atherton	Machine Maker.
Central Falls	Louis B. Barker	United States Cotton Co.
Central Falls	David Grove	United States Cotton Co.
Central Falls,	B. F. G. Linnell,	Yarns, Threads and Twines.
Centreville	James T. Ferguson	Warwick Mills.
Crompton	Charles D. Robinson	Crompton Co.
Davisville	Walter B. Knight	Reynolds Manufg. Co.
Fiskville	James Gee	Interlaken Dye Works.
Forestdale	Alphonso F. White	Forestdale Mfg. Co.
Georgiaville	A. E. Bosworth	Bernon Mills.
Lonsdale	Edward A. Mongeon	Lonsdale Mills.
Manville	A. Tenny White	Manville Co.
Natick	Charles M. Holmes	Natick Mills.
Pawtucket	V. T. Barber	Slater Cotton Co.
Pawtucket	William Washington Blades,	Lorraine Mfg. Co.
Pawtucket	Robert Burgess	Slater Cotton Co.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	Henry C. Dexter	Greene & Daniels Mfg. Co.
Pawtucket	Fred W. Easton	Easton & Burnham Machine Co.
Pawtucket	D. A. Everly	Cotton Mfr.
Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. E. Jenckes	The E. Jenckes Manufg. Co.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	E. R. Richardson	Howard & Bullough American Machine Co., Ltd.
Pawtucket	Dwight Seabury	12 East Ave.
Pawtucket	S. Willard Thayer	Dexter Yarn Co.
Pawtucket	Fred A. Wilde	A. T. Atherton Machine Co.
Peace Dale	William C. Greene	Peace Dale Manufg. Co.
Phenix	Henry R. Brown	Phenix Mill.
Pontiac	Walter B. Hall	Pontiac Mill, B. B. and R. Knight.
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	William Ames	Fletcher Mfg. Co.
Providence	George R. Babbitt	American Oil Co.
Providence	Edward R. Ballou	Ballou Yarn Co.
Providence	Truman Beckwith	Dyerville Manufg. Co.

Providence	J. Frank Braids	Charles S. Bush Co.
Providence	H. Martin Brown	U. S. Bobbin & Shuttle Co.
Providence	E. C. Bucklin	Interlaken Mills.
Providence	Harris H. Bucklin	Interlaken Mills.
Providence	Fred N. Bushnell	Rhode Island Co.
Providence	Charles H. Child	Standard Mill Supply Co.
Providence	Frederick I. Dana	The Textile Machinery Finishing Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	J. DeForest Danielson	Lockwood Co. and Lewiston Bleachery and Dye Works.
Providence	John W. Danielson	Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., & Lewiston Bleachery & Dye Works.
Providence	John Henry English	English Greene Co.
Providence	F. C. Fletcher	Lawton Spinning Co.
Providence	J. Herbert Foster	10 South Water St.
Providence	Arthur C. Freeman	Textile Finishing Machinery Co.
Providence	William Gammell	Berkeley Co.
Providence	Rufus B. Goff	Standard Mill Supply Co.
Providence	Henry T. Grant	Mercantile Mutual Fire Insurance Co.
Providence	John H. Hambly	Quidnick Mfg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co.
Providence	Elisha H. Howard	Cotton Goods Broker.
Providence	Frederic W. Howe	Crompton & Knowles Loom Works.
Providence	Daniel Jackson	B. B. & R. Knight.
Providence	Albert F. Knight	Box 835.
Providence	John E. Kendrick	American Supply Co.
Providence	Stephen A. Knight	Hebron Manufg. Co.
Providence	Webster Knight	B. B. & R. Knight's Mills.
Providence	W. C. Langford	86 Weybosset St.
Providence	J. Colby Lewis	23 Ralph St.
Providence	Charles Warren Lippitt	Silver Spring B. & D. Co.
Providence	Henry F. Lippitt	Social and Manville Cos.
Providence	Charles R. Makepeace	Box 973.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Thomas Mayor	Thomas Mayor & Son.
Providence	John G. McFadden	Nottingham Mill.
Providence	Charles H. Merriman, Jr.	Manville Co.
Providence	William C. Peirce	Elizabeth Mills.
Providence	Reuben Pilling, Jr.	104 Harrison St.
Providence	Stephen Minot Pitman	Narragansett Mutual Fire Ins. Co.
Providence	Charles A. M. Praray	Chas. A. M. Praray & Co.
Providence	Richard H. Rice	Providence Engineering Works.
Providence	George W. Robbins	Dyerville Mfg. Co.
Providence	Frank P. Sheldon	Industrial Trust Building.
Providence	Harry M. Smith	Standard Mill Supply Co.

Providence	Wilton H. Spencer	7 Exchange Place.
Providence	Daniel J. Sully	T. M. Reynolds & Co.
Providence	Robert Rennie Taft	P. O. Box 1443.
Providence	Robert W. Taft	Coventry Co.
Providence	Charles F. Taylor	Burgess Cop Tube Co.
Providence	D. M. Thompson	B. B. & R. Knight's Mills.
Providence	James T. Thornton	Thornton Machinery Co.
Providence	H. A. Tillinghast	The Textile Finishing Machinery Co.
Providence	A. Curtis Tingley	National Ring Traveler Co.
Providence	W. O. Todd	Lawton Spinning Co.
Providence	Robert B. Treat	Manufacturers' Fuel Co.
Providence	William P. Vaughan	Putnam Mfg. Co.
Quidnick	O. B. Parker	Quidnick Mfg. Co.
Riverpoint	Arthur F. Brackett	Royal Arctic and Valley Queen Mills.
Valley Falls	Edward B. Jennings	Samoset Co.
Valley Falls	John W. Ramsbottom	Samoset Co.
Warren	Arnold Schaer	Warren Manufg. Co.
Westerly	Robert Dow	Solway Mills.
Westerly	A. E. Henry	Solway Mills.
Westerly	Robert B. Meikle	Lorraine Mfg. Co.
Wickford	Joseph Warren Greene	
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Harry K. Drew	Clinton Mfg. Co.
Woonsocket	William Halliwell	Providence and Woonsocket Mills of the Lawton Spinning Co.
Woonsocket	W. G. Hartford	Hamlet Textile Co.
Woonsocket	Edward W. Houghton	Globe Mill, Manville Co.
Woonsocket	Henry S. Houghton, Sr.	61 Pond St.
Woonsocket	Albert C. Hoy	
Woonsocket	William N. Kimball	Social and Nourse Mills.
Woonsocket	Frederick Ott	Hamlet Textile Co.
Woonsocket	William A. Robinson	Manville Co.
Woonsocket	Charles E. Thomas	Forestdale Mfg. Co.

CONNECTICUT.

Baltic	Harold Lawton	Baltic Mills Co.
Danielson	Gordon A. Johnstone	Danielson Cotton Co.
Danielson	James Herbert Smith	Quinebaug Co.
Jewett City	Frederick D. Ballou	W. A. Slater Mills.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	H. C. Atwood	Williamsville Manufg. Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.
Killingly	C. H. Truesdell	Attawaugan Co.

Middletown	Joseph Merriam	Springfield Webbing Co.
Middletown	J. F. Powers	Spinning Mill.
Montville	Emory S. Rathbun	Pequot Mills.
Moosup	William J. Cray	Aldrich Mfg. Co.
New Haven	George S. Barnum	The Bigelow Co.
New London	Louis L. Hohn	Cor. Conn. Ave. and McDonald St.
Norwich	W. N. Blackstone	Attawaugan Co. and Totokett Mills Co.
Norwich	W. R. Burnham	
Norwich	C. H. Frisbie	Attawaugan Co.
Norwich	W. G. Henderson	Falls Co.
Norwich	Charles D. White	Uncasville Manufg. Co.
Norwich	Wm. I. Woodward	Shetucket Co.
Putnam	George W. Holt	Monohansett Manufg. Co.
Putnam	George A. Vaughan	Putnam Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Uncasville	Robert G. McMeehan	Uncasville Mfg. Co.
Versailles	John H. Holt	Totokett Mills Co.
Voluntown	George T. Briggs	The Briggs Mfg. Co.
Wauregan	James A. Atwood	Wauregan Co. & Quinebaug Co.
Wauregan	John Walter Atwood	Wauregan Co.
Willimantic	Peter Hardman	American Thread Co., Willimantic Mills.
Willimantic	Dickerson G. Baker	American Thread Co.
Willimantic	E. S. Boss	American Thread Co.
Willimantic	Joseph Mercer	Willimantic Cotton Mills Co.
Windsor Locks	J. R. Montgomery	The J. R. Montgomery Co.

NEW YORK.

Brooklyn	Hugh De Haven	De Haven Mfg Co.
Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Chadwicks	Bradford C. Divine	Utica Willowvale Bleaching Co.
Cohoes	David S. Johnston	Harmony Mills.
Cohoes	Henry C. Phillips	Harmony Mills.
Cohoes	William H. Robinson	No. 3 Harmony Mill.
Elmira	William H. Bilbrough	Elmira Knitting Mills and Conewawah Spinning Co.
Jamestown	Thomes Henry Smith	Jamestown Cotton Mill.
Newburgh	William J. Hadfield	124 Smith St.
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co.
New York City	D. C. Ball	5 Beekman St.
New York City	Percy H. Brundage	49 Wall St.
New York City	French Campbell	James Freeman Brown Co.
New York City	Albert C. Case	25 Broad St. Room 1213.

New York City	J. E. Cheesman	Cheesman Cotton Gin Co.
New York City	C. C. Cowan	27 William St.
New York City	Charles Henry Davis	25 Broad St.
New York City	L. L. Flemming	American Cotton Co.
New York City	Vladimir F. Gnesin	68 Broad St
New York City	Frederick Stewart Greene	American Mfg. Co.
New York City	Ernest L. Hill	Renfrew Mfg. Co.
New York City	Arthur B. Mann	J. H. Martin & Co.
New York City	John R. Mitchell	Mitchell-Bissell Co.
New York City	Arthur Parkinson	Arabol Mfg. Co.
New York City	Duncan D. Parmly	Johnson Mfg. Co. & Dunbar Mills Co.
New York City	Vladimir P. Polevoy	120 Broadway
New York City	Theodore H. Price	Cotton Dealer.
New York City	William N. Shaw	The Lincoln Iron Works & Jackson Architectural Iron Works.
New York City	George A. Wies	Eureka Fire Hose Co.
New York City	George H. Watson	The Northern Engineering Co.
New York Mills, Oneida Co.,	John P. Campbell,	New York Mills.
Syracuse	Sanford E. Loring	341 Delaware St.
Utica	George DeForest	Utica Steam and Mohawk Valley Cotton Mills.
Utica	George E. Farrell	Utica Spinning Co.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills and Mohawk Valley Cotton Mills.
Utica	Pardon B. Sanford	Utica Spinning Co.
Utica	Albion K. Searls	Oneita Knitting Mills.
Utica	John B. Wild	Oneita Knitting Mills.

NEW JERSEY.

East Newark	Halsey Connett	Clark Mile End Spool Cotton Co.
Gloucester City	Philip H. Fowler	417 Monmouth St.
Gloucester	George W. Turner	Argo Mills Co.
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Jersey City	Maxwell Grierson	Jas. Chadwick & Bro., Ltd.
Jersey City	B. L. Stowe	Eureka Fire Hose Co.
Millville	John F. Reardon	Millville Mfg. Co.
Newark	William H. Loftus	Clark Thread Co.
New Brunswick	William Henry Hobbs	Johnson & Johnson Co.
New Brunswick	William H. Ritter	Johnson & Johnson.
Passaic	E. W. Davenport	Brighton Mills.
Passaic	Dudley T. Lyall	Brighton Mills.
Passaic	William L. Lyall	Brighton Mills.
Paterson	John W. Ferguson	Paterson Nat. Bank Bldg.

PENNSYLVANIA.

Chester	W. T. Galey	Aberfoyle Manufg. Co.
Chester	D. Edwin Irving	The Irving & Leiper Manufg. Co.
Chester	D. Irving Trainer	Agt. Lincoln Mfg. Co.
Frankford, Phila.	Daniel Clark	Wingohocking Cotton Mills.
Frankford, Phila.	Walter R. Garsed	Wingohocking Cotton Mills.
Lancaster	Henry G. McCarter	John Farnum & Co. Conestoga Mills 2 & 3.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Philadelphia	Robert Beatty	Robt. Beatty & Co.
Philadelphia	T. Ashby Blythe	Ashby Cotton Mills.
Philadelphia	Alfred H. Burnham	Glasgow Mills.
Philadelphia	Harry W. Butterworth	H. W. Butterworth & Sons.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.
Philadelphia	Byron F. Card	300 Chestnut St.
Philadelphia	Frederick A. Downes	Factory Mutual Fire Insurance Cos.
Philadelphia	Edward W. France	Philadelphia Textile School.
Phildelphia	Simon Friedberger	Friedberger Mfg. Co.
Philadelphia	Merrill A. Furbush	2015 North 33rd St.
Philadelphia	Otto Goetze	Glasgow Mills, Kensington Station.
Philadelphia	John T. Greenwood	R. Greenwood & Bault.
Philadelphia	Henry S. Grove	Argo Mills Co.
Philadelphia	James Henry	Thomas Henry & Sons.
Philadelphia	Wililam G. Henry	Thomas Henry & Sons.
Philadelphia	W. C. Houston	Hope Mills Mfg. Co.
Philadelphia	John H. Lorimer	Ontario and Lawrence Sts.
Philadelphia	David Milne	Washington Ave and 10th & 11th Sts.
Philadelphia	Edward H. Sanborn	Cold Spring Bleach. & Fin. Works.
Philapelphia	Albert E. Schofield	Delph Spinning Co.
Philadelphia	William T. Westerman	Ontario Spinning Co.
Philadelphia	George Wood	Millville Mfg. Co.
Philadelphia	John P. Wood	521 N. 22nd St.
Philadelphia	Oscar W. Wood	Germantown Spinning Co.
Pittsburg	J. A. Shepherd	The Stirling Co.
Yardley	Theodore C. Search	Cold Spring Bleaching and Finishing Works.
Yardley	R. Irving Tobey	Cold Spring Bleaching and Finishing Works.

DELAWARE.

Wilmington	William P. Bancroft	Joseph Bancroft & Sons Co.
Wilmington	Daniel Moore Bates	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	E. Stanley Gary	Gary Mfg. Co.
Baltimore	James A. Gary	Gary Mfg. Co.
Baltimore	Wm. E. Hooper	Woodberry Division of Mt. Vernon Woodberry Co.
Baltimore	Charles K. Oliver	Continental Bldg.
Ilchester	Samuel F. Patterson	Thistle Mills Co.

NORTH CAROLINA.

Asheville	William Whittam, Jr.	The William Whittam Textile Co.
Charlotte	S. B. Alexander, Jr.	S. B. Alexander, Jr. Co.
Charlotte	R. M. Miller, Jr.	Elizabeth Mills.
Charlotte	Daniel A. Tompkins	D. A. Tompkins Co.
Durham	O. W. Stites	Elliott Fuel Saving Co.
Fayetteville	Walter L. Holt	Holt-Morgan Mills.
Greensboro	Caesar Cone	Proximity Mfg. Co.
Greensboro	Farquharson J. Muir	Cone Export & Commission Co.
Hope Mills	Frank H. Cotton	Hope Mills Mfg. Co.
Lincolnton	R. S. Reinhardt	Elm Grove Cotton Mills.
Mountain Island	W. T. Jordan	Mt. Island Manufg. Co.
Winston-Salem	John W. Fries	F. & H. Fries.

SOUTH CAROLINA.

Chester	William G. Nichols	Springstein Mills.
Columbia	Louis I. Guion	Columbia Mills Co.
Columbia	James Sumter Moore	Olympia & Richland Cotton Mills.
Columbia	W. H. Rose	Richland, Granby & Olympia Cotton Mills.
Columbia	Edward W. Thomas	Richland, Granby & Olympia Mills.
Columbia	W. B. Smith Whaley	Richland & Granby Cotton Mills.
Gaffney	H. D. Wheat	Gaffney Mfg. Co. and Orient Mfg. Co.
Graniteville	T. H. Rennie	Graniteville Mfg. Co.
Greenville	James B. Duggan	Union Bleaching and Finishing Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co. and Aiken Manufg. Co.
Newberry	Edward B. Wilbur	Mollohon Mfg. Co.
Pelham	D. G. Sunderland	The Pelham Mills.

GEORGIA.

Aragon	D. E. McGaw	Aragon Mills.
Atlanta	Samuel A. Carter	Gate City Cotton Mills.
Atlanta	W. L. Draper	Dodge Mfg. Co.

Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Atlanta	Harry W. Kimball	Fulton Bag and Cotton Mills.
Atlanta	William M. Nixon	Atlanta Woolen Mills.
Atlanta	James R. Pearce	560 South Pryor St.
Augusta	Thomas Barrett, Jr.	Langley & Aiken Mills.
Augusta	John W. Chafee	The Sibley Mfg. Co.
Augusta	Henry J. Forsyth	The Sibley Mfg. Co.
Augusta	T. I. Hickman	Graniteville Mfg. Co.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Peleg A. Rhodes	Cotton Mill Mutual Fire Ins. Co.
Augusta	Joel Smith	J. P. King Mfg. Co.
Augusta	George R. Stearns	Riverside Mills.
Augusta	Eugene F. Verdery	Warren Mfg. Co.
Chattahoochee	W. R. B. Whittier	Whittier Mills.
Columbus	E. N. Clemence	Cotton Manufacturer.
Columbus	Frederick B. Gordon	Columbus Mfg. Co.
Columbus	Charles H. Gorton	Columbus Mfg. Co.
Columbus	Walter Rigby	Bibb Mfg. Co.
Columbus	George W. Towne	Columbus Power Co.
East Point	Edward C. Beach	Gate City Cotton Mills.
Griffin, Spalding Co.	Albert G. Martin	Kincaid Manufg. Co.
Harmony Grove	Charles M. Sears	Harmony Grove Cotton Mills.
Lawrenceville	C. Enos Bean	Lawrenceville Mfg. Co.
Lawrenceville	Albert E. McDonald	Lawrenceville Mfg. Co.
Lindale	Henry P. Meikleham	Mass. Mills in Georgia.
Macon	W. H. Richmond	Bibb Mill No. 2.
Macon	Broadus E. Willingham	Willingham Cotton Mills.

TENNESSEE.

Knoxville	William T. Lang	Brookside Mills.
Memphis	Jerome Hill	Jerome Hill Cotton Co.

ILLINOIS.

Chicago	Frederick A. Flather	Manufacturing International Harvester Co.

MISSISSIPPI.

Agricultural College	William E. Winchester	Mississippi Textile School.
Starkville	Arthur Whittam	John M. Stone Cotton Mills.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

KENTUCKY.

Henderson	Paul J. Marrs	Henderson Cotton Mills.
Louisville	Philip S. Tuley	Louisville Cotton Mills Co.

ALABAMA.

Birmingham	B. B. Comer	Avondale Cotton Mills.
Birmingham	Joseph O. Hannum	1805 10th Ave. So.
Cordova	Scott Maxwell	Indian Head Mills of Ala.
Pell City	Arthur J. Draper	Pell City Mfg. Co.
Pell City	Edward T. Garsed	Pell City Mfg. Co.

COLORADO.

Denver	John L. Jerome	Overland Cotton Mill Co.

CANADA.

Province of Ontario.

Cornwall	S. Greenwood	The Canadian Colored Cotton Mills Co., Ltd.
Hamilton,	Charles Owen Dexter	The Candian Colored Cotton Mills Co., Ltd.
Hamilton,	James M. Young	Hamilton Cotton Co.
Ottawa	Louis Simpson	Victoria Chambers.

Province of Quebec.

Montreal	Alfred Hawkesworth	Merchants Cotton Co.
Montreal	Fred Hawkesworth	Merchants Cotton Co.
Montreal	D. K. McLaren	751 Craig St.
Montreal	A. B. Mole	Dominion Cotton Mills Co.
Valleyfield	Ernest E. Clark	Montreal Cotton Co.
Valleyfield	Fred Lacey	Montreal Cotton Co.
Valleyfield	Charles H. Potter	Montreal Cotton Co.
Valleyfield	Lewis J. Young	Montreal Cotton Co.

NEW BRUNSWICK.

Milltown	Lewis Dexter, Jr.	The Canadian Colored Cotton Mills Co., Ltd.
St. John	John B. Cudlip	Cornwall and York Cotton Mills Co.

ENGLAND.

Huddersfield	John Sykes	English Card Clothing Co.
Matlock, Derbyshire,	John Edward Lawton . .	American Thread Co.
Norfolk, London, W. C.,	William F. Parish, Jr. . .	Vacuum Oil Co. (Tech. Dept.)

RUSSIA.

Moscow	Vladimir Malinin . . .	Prochoroff Three Hill Mfg. Co.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	20
New Hampshire	30
Vermont	1
Massachusetts	341
Rhode Island	113
Connecticut	35
New York	40
New Jersey	14
Pennsylvania	34
Delaware	2
Maryland	5
North Carolina	12
South Carolina	13
Georgia	31
Tennessee	2
Illinois	1
Mississippi	2
Louisiana	1
Kentucky	2
Alabama	5
Colorado	1
Province of Ontario	4
Province of Quebec	8
New Brunswick	2
England	3
Russia	1
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IN MEMORIAM.

PATRICK T. CREED.

PATRICK T. CREED was born in Manchester, England, Feb. 3, 1843, and came to this country when a young man, first to Norwich, Conn., and then to Taunton, Mass., where he was identified with the Old Brick Mill and afterwards became superintendent of the Hopewell Mill and became permanently identified with cotton manufacturing in that portion of the state.

He was of an inventive turn of mind and took out patents on various machines and devices used in the manufacture of cotton He was one of the commissioners to the Centennial Exhibition at Philadelphia in 1876.

He died May 18, 1903, and is survived by a widow, six. daughters and one son, MARK B. CREED who is superintendent at the Wamsutta Mills in New Bedford and an instructor in the New Bedford Textile School.

Mr. CREED became a member of this Association Sept. 22, 1896, and was exceedingly regular in his attendance at the meetings in which he took great interest.

JOHN H. PARKS.

JOHN H. PARKS was born at St. John, New Brunswick, Sept. 9, 1836, and after his graduation became a civil engineer on the

European and North American Railway. In 1861 he joined the firm of William Parks & Son who started the first cotton mill in Canada for which he bought the machinery in England. In 1870, owing to the death of the senior member of the firm, the whole management devolved on Mr. JOHN H. PARKS.

He took great interest in public affairs, occupying local offices and was also connected with the militia in which he rose to the rank of major; he was for many years president of the Provincial Rifle Association.

He was the first outside of the United States to become a member of this Association which he joined April 24, 1878.

He died Sept. 7, 1903, and is survived by his widow and five daughters and four sons.

JOHN R. ROSTRON.

JOHN R. ROSTRON was born at Lawrence, Mass., in 1856, and was for a number of years employed in Lowell and later superintendent of a mill at Cordova, Alabama, and later came to the Lancaster Mills at Clinton, Mass.

He died July 12, 1903, leaving a widow and three children.

He became a member of this Association Sept. 29, 1898.

WILLIAM H. STRATTON.

Captain WILLIAM H. STRATTON was born at New Haven in 1854, and was in early life connected with the introduction of automatic sprinklers and fire apparatus, afterwards being connected with several of the Factory Mutual Insurance Companies and in 1895 became assistant manager of the Factory Insurance Association of Hartford, Conn. He was gifted with great

capacity for organization and was one of the leading authorities on construction and fire protection of mill property. He held an important position among Underwriters, especially for the systematic manner in which he applied his experience in the form of illustrated specifications for construction and equipment of fire apparatus.

He died August 13, 1903, as a result of a sickness contracted while in Great Britain attending the meeting of the British Fire Protection Committee, where he made an address.

He was largely interested in the militia in which he held numerous offices, the last being that of captain on the Brigade Staff. He was a member of the Masons, the American Society of Mechanical Engineers and several clubs and societies.

He joined this Association October 28, 1897.

He is survived by his widow and two children.

PROCEEDINGS.

In accordance with the legal notice, the stated semi-annual meeting of the Association was held at Hotel Aspinwall, Lenox, Mass., September 29–October 1, 1903. The following 110 members and 123 guests, including 76 ladies, were present.

ACTIVE MEMBERS.

JOSEPH D. AIKEN, Taftville, Conn.
THOMAS ARMSTRONG, North Pownal, Vt.
EDWARD ATKINSON, Boston, Mass.
E. W. ATKINSON, Boston, Mass.
H. C. ATWOOD, Killingly, Conn.
GEORGE A. AYER, Easthampton, Mass.
LEWIS E. BARNES, Methuen, Mass.
DANIEL MOORE BATES, Rockford, Wilmington, Del.
A. C. BENT, Taunton, Mass.
JNO. H. C. CHURCH, Gt. Barrington, Mass.
CHARLES H. COLLINS, Ashton, R. I.
FRANK B. COMINS, Boston, Mass.
JOHN J. CONNELL, Lowell, Mass.
CHARLES W. DENNETT, North Adams, Mass.
EDWARD P. DENNIS, Lowell, Mass.
CHARLES A. DENNY, Leicester, Mass.
HENRY C. DEXTER, Pautucket, R. I.
GEORGE OTIS DRAPER, Hopedale, Mass.
WILLIAM EVANS, Fall River, Mass.
M. F. FOSTER, Milford, N. H.
ALFRED M. GOODALE, Boston, Mass.

GEORGE P. GRANT, Jr., Fitchburg, Mass.
D. W. GRAY, Utica, N. Y.
FREDERICK STUART GREENE, New York City.
JOHN GREGSON, Fiskdale, Mass.
ARTHUR H. GULLIVER, Waltham, Mass.
Z. D. HALL, Adams, Mass.
JOHN F. HAMLET, Fall River, Mass.
WILLIAM HAYES, Auburn, Me.
JOSEPH B. JAMIESON, Boston, Mass.
LEONARD JOHNSON, Fall River, Mass.
ROLAND R. KELLY, Williamstown Sta., Mass.
NATHANIEL B. KERR, New Bedford, Mass.
FRED LACEY, Valleyfield, P. Q.
WALTER H. LANGSHAW, New Bedford, Mass.
WILLIAM H. LOFTUS, Newark, N. J.
ARTHUR H. LOWE, Fitchburg, Mass.
FREDERICK B. MACY, New Bedford, Mass.
CHARLES T. MAIN, Boston, Mass.
HENRY F. MANSFIELD, Utica, N. Y.
THOMAS MAYOR, Providence, R. I.
JOSEPH MERRIAM, Middletown, Conn.
A. B. MOLE, Montreal, P. Q.
J. R. MONTGOMERY, Windsor Locks, Conn.
ALBERT W. NOONE, Peterboro, N. H.
WILLIAM D. PENNELL, Lewiston, Me.
HAVEN C. PERHAM, Lowell, Mass.
CHARLES T. PLUNKETT, Adams, Mass.
WILLIAM C. PLUNKETT, Adams, Mass.
J. F. POWERS, Middletown, Conn.
THEODORE ELLIS RAMSDELL, Housatonic, Mass.
FRANK P. SHELDON, Providence, R. I.
J. C. SMITH, Fall River, Mass.
THOMAS HENRY SMITH, Jamestown, N. Y.
HENRY B. SPRAGUE, Lynn, Mass.
WALTER F. STILES, Fitchburg, Mass.
JAMES W. TAYLOR, Taunton, Mass.
JAMES P. TOLMAN, Boston, Mass.
ROBERT B. TREAT, Providence, R. I.
OSCAR B. TRUESDELL, Newtonville, Mass.

HERBERT E. WALMSLEY, New Bedford, Mass.
WILLIAM T. WESTERMAN, Philadelphia, Pa.
JOHN B. WILD, Utica, N. Y.
EBEN C. WILLEY, Boston, Mass.
C. J. H. WOODBURY, Lynn, Mass.

ASSOCIATE MEMBERS.

EUGENE C. ANDRES, Boston, Mass.
J. FRANK BRAIDS, Providence, R. I.
HENRY GORDON BRINCKERHOFF, Boston Mass.
CHARLES B. BURLEIGH. Boston, Mass.
EUGENE E. BURNHAM, Lawrence Mass.
MALCOLM CAMPBELL, Woonsocket, R. I.
CHARLES H. CHILD, Providence, R. I.
MELVIN H. COFFIN, New York City.
THOMAS G. COX, Taunton, Mass.
C. E. W. DOW, Boston, Mass.
FRED W. EASTON, Pawtucket, R. I.
G. B. ENMONS, Lawrence, Mass.
JOHN HENRY ENGLISH, Providence, R. I.
JOHN T. FYANS, Fall River, Mass.
H. P. GARLAND, Biddeford, Me.
VLADIMIR F. GNESIN, New York City.
RUFUS B. GOFF, Providence, R. I.
SAMUEL M. GREEN, Holyoke, Mass.
CHARLES C. HEDRICK, Lowell, Mass.
A. H. HOWARD, Worcester, Mass.
FREDERIC W. HOWE, Providence R. I.
JOHN E. KENDRICK, Providence, R. I.
FRANK B. KENNEY, Lowell, Mass.
JOSEPH C. KING, Boston, Mass.
JOHN H. LORIMER, Philadelphia, Pa.
STEPHEN C. LOWE, Boston, Mass.
JOHN MCCULLOUGH, New Bedford, Mass.
JOHN R. MITCHELL, New York City.
WILLIAM R. NOONE, Boston, Mass.
SIDNEY B. PAINE, Boston, Mass.
ARTHUR PARKINSON, New York City.
WILLIAM N. SHAW, New York City.

HARRY M. SMITH, Providence, R. I.
H. E. STAFFORD, Readville, Mass.
JAMES STRANG, Indian Orchard, Mass.
JAMES T. THORNTON, Providence, R. I.
RIENZI W. THURSTON, Fall River, Mass.
H. A. TILLINGHAST, Providence, R. I.
A. CURTIS TINGLEY, Providence, R. I.
ALLISON W. TRAFFORD, Fall River, Mass.
CLEMENT A. WAKEFIELD, Biddeford, Me.
WALTER S. WATSON, Lowell, Mass.
ROBERT C. WEBSTER, Boston, Mass.
FRED A. WILDE, Pawtucket, R. I.
ERVING YALE WOOLLEY, Boston, Mass.

GUESTS.

J. J. BALLAUGH.
HENRY J. BALLOU.
Dr. J. B. BEEBE.
EDGAR H. BERRY.
HOWARD W. BIBLE.
E. E. BLAKE.
WARREN BREED.
A. C. BUTLER.
ARTHUR O. BUZZELL.
J. SEYMOUR CARTER.
FRANK CHAMPLAIN.
JOSEPH B. CHILD.
CHARLES A. COOKE.
J. A. COOPER.
ROGERS W. DAVIS.
AUSTIN R. DODGE.
Dr. GEORGE W. GAY.
GEORGE S. HARRIS.
T. F. HAVEY.
GARDNER T. HAWKINS.
MILTON P. HIGGINS.
CARROL HUTCHINS.
J. J. JEFFERSON.
CHARLES C. JOHNSON.
RUSSELL B. LOWE.
D. E. MANSON.
J. R. MCKEE.
W. A. MOYER.
J. C. MULLER.
E. A. MUNSELL.
FRANK L. NAGLE.
W. P. NAIRN.
Dr. F. A. C. PERRINE.
CHARLES T. PLUNKETT, Jr.
Hon. W. B. PLUNKETT.
AMASA PRATT.
F. C. RICHARDSON.
C. ROBBINS.
ARTHUR S. SALOMON.
A. P. SMITH.
CHESTER W. SMITH.
A. B. SPENCER.
SAMUEL H. STEELE.
B. G. UNDERWOOD.
HERBERT WALMSLEY.
WILLIAM WELCH.
J. A. WHITCOMB.

Mrs. Thomas Armstrong.
Mrs. H. C. Atwood.
Mrs. George A. Ayer.
Mrs. Henry J. Ballou.
Mrs. Gertrude Child Barrows.
Mrs. Daniel M. Bates.
Mrs. L. E. Barnes.
Mrs. Howard W. Bible.
Mrs. E. E. Blake.
Mrs. Warren Breed.
Mrs. Henry G. Brinckerhoff.
Mrs. Charles B. Burleigh.
Mrs. J. H. C. Church.
Miss Alice M. Collins.
Mrs. Charles H. Collins.
Mrs. John J. Connell.
Mrs. F. W. Crocker.
Miss Bertha Denny.
Miss Louise B. Dodge.
Mrs. John H. English.
Mrs. William Evans.
Mrs. H. P. Garland.
Mrs. George W. Gay.
Mrs. George P. Grant, Jr.
Mrs. Frederick S. Greene.
Mrs. Samuel M. Green.
Mrs. John Gregson.
Mrs. John F. Hamlet.
Mrs. A. H. Howard.
Mrs. Leonard Johnson.
Mrs. Frank B. Kenney.
Miss Marion E. Kerr.
Mrs. N. B. Kerr.
Mrs. Fred Lacey.
Mrs. W. H. Langshaw.
Mrs. William H. Loftus.
Miss Anna Lorimer.
Mrs. John H. Lorimer.
Mrs. Arthur H. Lowe.
Mrs. Stephen C. Lowe.
Mrs. Frederick B. Macy.
Mrs. Charles T. Main.
Mrs. Henry F. Mansfield.
Miss Alice McCullough.
Mrs. Joseph Merriam.
Mrs. A. B. Mole.
Mrs. J. R. Montgomery.
Mrs. A. V. Moulton.
Mrs. Haven C. Perham.
Mrs. F. A. C. Perrine.
Mrs. Charles T. Plunkett.
Mrs. W. B. Plunkett.
Mrs. W. C. Plunkett.
Mrs. Amasa Pratt.
Mrs. H. A. Priest.
Mrs. William N. Shaw.
Miss Bertha Sheldon.
Mrs. Frank P. Sheldon.
Mrs. Harry M. Smith.
Mrs. J. C. Smith.
Mrs. Henry B. Sprague.
Miss Helen F. Thompson.
Mrs. James T. Thornton.
Mrs. Rienzi W. Thurston.
Mrs. A. Curtis Tingley.
Mrs. A. W. Trafford.
Mrs. Robert B. Treat.
Miss Beatrice Walmsley.
Miss Marguerite Walmsley.
Mrs. J. A. Whitcomb.
Miss Alice P. Woodbury.
Miss Laura B. Woodbury.
Mrs. William Welch.
Mrs. Fred A. Wilde.
Mrs. C. J. H. Woodbury.
Miss Louise Woodbury.

FIRST SESSION.

HOTEL ASPINWALL, LENOX, MASS.
WEDNESDAY, September 30, 1903.

The meeting was called to order at 9.00 A. M., President HERBERT E. WALMSLEY in the chair.

The PRESIDENT. Gentlemen, the hour of meeting having arrived you will please come to order and we will proceed with the business before us by first requesting the Secretary to read the call to the meeting.

The Secretary read the following call for the meeting.

BOSTON, MASS., September 1st, 1903.

To the Members:

Notice is hereby given that the stated Semi-Annual Meeting of the Association will be held at Hotel Aspinwall, Lenox, Mass., Tuesday, Wednesday and Thursday, September 29 to October 1, 1903.

The sessions will be held in the ball room of the hotel, at 8.15 P. M., on each day of the meeting.

In accordance with the notice given at the 74th Meeting an amendment will be submitted in accordance with Article 15 of the Constitution and By-Laws, namely,—

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the

Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

All articles of the Constitution and By-Laws, beginning with Article 5, shall be increased in number to the next cardinal number."

In accordance with the Constitution and By-Laws the above will require the assent of two-thirds of the members present and voting thereon for its adoption.

By Order of the Board of Government,

C. J. H. WOODBURY,
Secretary.

The full programme will not be issued until the meeting but papers are expected on the following subjects:—

Adjustment of Preparing and Spinning Machinery.
Advantages of Steam Turbines for Textile Mills.
Blending of Cotton.
Bobbin Filling; Its Tendency to Kink.
Gambling in Cotton.
Improvements in Cards.
Influence of Electricity on the Development of Water Power.
Mud Fuel.
Reminiscences.
Storage Battery Locomotives for Mill Yards.
Waxes in Warp Sizing.

The Board of Government has selected Hotel Aspinwall for the Autumn meeting on account of its attractions and the beauties of the surrounding country rendering it peculiarly desirable for the families and guests of the members.

There is a fine orchestra connected with the Hotel which furnishes morning and evening concerts and music for dancing.

There is a large stable, having numerous vehicles, including brakes which will take parties, connected with the hotel; and also automobiles can be hired. Those desiring to play golf can use the Aspinwall Course owned by the hotel or arrangements can be made if advance notice be

given to obtain privileges for the members on the courses of the Country Clubs at Pittsfield, Stockbridge and Lee.

Tuesday evening will be devoted to a musical entertainment by some of the members.

The first session will be held in the Music Room of the Aspinwall at 9.00 A. M., Wednesday, September 30. At this session the Association will be welcomed by Hon. WILLIAM B. PLUNKETT, and President HERBERT. E. WALMSLEY will give the opening address. The second and third sessions will be held in the Music Room at 8.15 P. M., Wednesday and Thursday.

On Thursday afternoon, October 1st, there will be an excursion to the works of the Stanley Electric Manufacturing Company at Pittsfield, the party leaving the hotel in carriages at 2 o'clock to the electric railroad, where special cars will take the party to the works, a distance of about seven miles. As it is assumed that the ladies would not be especially interested in an establishment of this nature, provision will be made for the trolley cars to take them to Cheshire and return while the men are in the works. Tickets for this trip, complimentary by the Stanley Electric Manufacturing Company, may be obtained at the hotel desk up to Thursday noon.

The Post Office and Telephone address of the hotel is at Lenox, Mass.; the Western Union Telegraph Company has an office in the hotel.

TRANSPORTATION.

The Raymond & Whitcomb Company will have charge of the transportation; one party will leave the South Terminal Station, Boston, in a special train of drawing room cars at 1.00 P. M., Tuesday, September 29, stopping to take up passengers en route who may have tickets for this special train, and reach Pittsfield at 5.10 P. M., and arrive at the hotel at about 6.00 o'clock. The baggage will reach the rooms at about 7.00 P. M. Train will leave from the Grand Central Station, New York, at 3.35 P. M., on the same date and reach Pittsfield at 7.30 P. M. Persons attending the meeting from the West will take a train leaving Syracuse at 11.10 A. M. and arrive at Pittsfield at 4.45 P. M.

At Pittsfield carriages will be taken for a ride of six miles to Hotel Aspinwall at Lenox, Mass.

On Friday morning those of the party returning to Boston or stations on the Boston & Albany Railroad east of Pittsfield will leave the hotel at 11.00 A. M., by carriages, reaching Pittsfield in time for the train leaving

for Boston at 12.55 P. M., and arriving in Boston at 4.55 P. M., lunch at Wendell House, Pittsfield, Mass.

Passengers for New York, Albany or points West of Albany will lunch at the Aspinwall Hotel and leave at 1.40 P. M. by carriages, reaching Pittsfield for the train which leaves at 2.40 P. M. and arrives in New York at 6.55 P. M.

Passengers for Albany and points West will leave Pittsfield at 2.30 P. M., arrive in Albany at 3.50 P. M., Utica 6.10 P. M., Syracuse 7.25 P. M.

The expenses of the trip, including parlor car service, meals en route, transportation, care of baggage, and hotel bills will be from Boston or New York, $25.00. Rooms with connecting bath room are $2.00 daya additional. Arrangements may be made for staying after the close of the meeting.

Applications for tickets in these special cars should be made to the Raymond & Whitcomb Company, 305 Washington St., Boston, Mass.; 1005 Chestnut St., Philadelphia; 25 Union Square, New York City; O. E. Jenkins, University Bldg., Syracuse; or M. M. Hennessy, New York Central R. R. Station, Utica, N. Y.

The Messrs. Raymond & Whitcomb will furnish tickets and make hotel arrangements at reduced rates from any other points, although this arrangement does not prevent any members from travelling independently if they prefer so to do.

It is suggested that those who travel independently should engage rooms in advance from Hotel Aspinwall, Lenox, Mass., which will quote rates on application.

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment, but other souvenir badges will be given to the guests of members.

It is desired that applications for membership shall be received as far as possible in advance of the meeting.

A blank proposition for membership is enclosed for convenience in submitting the names of any who would be desirable members. Many persons have not become members because they have not been invited. Candidates for membership will receive the same privileges as the members. Blank propositions are also inside the front cover of the Transactions, or will be sent on application.

Members who have overlooked their postal card receipts for Transactions are requested to give the matter attention, as it is only through this means that the headquarters of the Association are able to know

that members receive the volumes and notices to which they are entitled, and to keep an accurate record for sending Transactions and notices to members.

It is important that the Association should be promptly informed of changes of address of any members, in order that they may promptly receive their copies of Transactions.

The SECRETARY. Mr. President, I hereby certify that in compliance with Article 14 of the By-Laws, I served each member of the Association with a copy of the above notice by mail at least ten days in advance of this meeting and that a quorum is now present in obedience thereto for the legal transaction of any business which may come before this meeting.

The PRESIDENT. The Secretary will now be good enough to read the records of the last meeting.

The records of the last meeting were read by the Secretary and on motion of Mr. J. R. MONTGOMERY, it was voted that they should be accepted.

The programme for the meeting was as follows:

PROGRAMME.

Tuesday, September 29, 1903, at 9.00 P. M.

An entertainment will be given in the music room by some of the members.

First Session, Wednesday, September 30, 1903, at 9.00 A. M.

Call to Order.

Business.

Welcome to the Berkshires,
HON. WILLIAM B. PLUNKETT, Adams, Mass.

President's Address,
HERBERT E. WALMSLEY, New Bedford, Mass.

The Influence of Electricity on the Development of Water Powers,
FREDERIC A. C. PERRINE, D.Sc., Pittsfield, Mass.

Storage Battery Locomotives for Mill Yards,
EDGAR H. BERRY, New Brighton, N. Y.

Reminiscences,
EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

Second Session, Wednesday, September 30, 1903, at 8.15 P. M.

Waxes in Warp Sizing,
DANIEL MOORE BATES, Wilmington, Delaware.

Bobbin Filling; Its Tendency to Kink,
JOHN GREGSON, Fiskdale, Mass.

Gambling in Cotton,
JOSEPH D. AIKEN, Taftville, Conn.

An Improvement in Cards,
WILLIAM HAYES, Auburn, Maine.

Music by the Aspinwall Orchestra at the close of the Session.

Third Session, Thursday, October 1, 1903, at 2.00 P. M.

Thursday afternoon will be devoted to an excursion to the works of the Stanley Electric Manufacturing Company at Pittsfield, the party leaving the hotel in carriages at 2 o'clock to the electric railroad, where special cars will take the party to the works, a distance of about seven miles. As it is assumed that the ladies would not be especially interested in an establishment of this nature, provision will be made for the trolley cars to take them to Cheshire and return while the men are in the works. Tickets for this trip, complimentary by the Stanley Electric Manufacturing Company, may be obtained at the hotel desk up to Thursday noon.

Fourth Session, Thursday, October 1, 1903, at 8.15 P. M.

Advantages of Steam Turbines for Textile Mills,
AUSTIN R. DODGE, Schenectady, N. Y.

Mud Fuel,

EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

Blending of Cotton,

DANIEL CLARK, Frankford, Philadelphia, Pa.

Adjustment of Preparing and Spinning Machinery,

EBEN C. WILLEY, Boston, Mass.

Ballot for Candidates for Membership.

The Committee on Meeting, wearing white rosettes, consists of Messrs. CHARLES T. PLUNKETT, *Chairman*, GEORGE A. AYER, JOHN H. C. CHURCH, CHARLES W. DENNETT, GEORGE P. GRANT, Jr., Z. D. HALL, HAROLD LAWTON, THEODORE E. RAMSDELL and the President and the Secretary, who will assist in the detailed arrangements of the meeting.

On Friday morning those of the party having excursion tickets and returning to Boston or stations on the Boston & Albany Railroad east of Pittsfield will leave the hotel at 11.00 A. M., by carriages, reaching Pittsfield in time to lunch at the Wendell House, Pittsfield, and leave Pittsfield at 12.55 P. M., and arrive in Boston at 4.55 P. M.

Passengers for New York, Albany or points west of Albany will lunch at the Aspinwall Hotel and leave at 1.40 P. M., by carriages, reaching Pittsfield for the train which leaves at 2.40 P. M. and arrives in New York at 6.55 P. M.

Passengers for Albany and points West will leave Pittsfield at 2.30 P. M., arrive in Albany at 3.50 P. M., Utica 6.10 P. M., Syracuse 7.25 P. M.

The PRESIDENT. The next business is the balloting on the proposed change in the Constitution providing for life membership.

The SECRETARY. Mr. President, notice of the following amendment to the Constitution and By-Laws was given at the seventy-third meeting of the Association, April 22, 1903, and recorded in the Transactions, Vol. 73, page 106.

It is submitted to the pleasure of the meeting with the approval of the Board of Government.

BALLOT FOR AMENDMENT TO CONSTITUTION AND BY-LAWS.

In accordance with the notice given at the seventy-fourth meeting the

following amendment is submitted in accordance with Article 15 of the Constitution and By-Laws, namely:

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

All articles of the Constitution and By-Laws, beginning with Article 5, shall be increased in number to the next cardinal number."

In accordance with the Constitution and By-Laws the above will require the assent of two-thirds of the members present and voting thereon for its adoption.

Write yes or no,

Name of person voting,

Mr. ARTHUR H. LOWE. Mr. President, I move the resolution be approved and that we proceed to ballot at once for this amendment.

The PRESIDENT. I appoint Mr. Z. D. HALL, Mr. JAMES P. TOLMAN and Mr. EBEN C. WILLEY to distribute, collect and count the ballots.

Will the committee be good enough to collect the ballots and report the result of the voting later in the session.

The SECRETARY. Mr. President, while this ballot is being taken I will present to the Association by the instruction of the Board of Government a preamble and resolution which was submitted as the result of a paper on Foreign Markets for American Export Goods at the last meeting. The subject was considered by the Board of Government and the following drawn by one of the members and submitted for the pleasure of this meeting.

WHEREAS, The normal output of American Cotton Mills now exceeds the domestic demand and is increasing more rapidly than the latter,

resulting in a constantly growing surplus that must either be exported or thrown upon the home market under conditions that may result in serious price disturbance and loss; and

WHEREAS, Foreign markets are at present taking a considerable portion of this surplus and are capable of taking much larger quantities if properly developed, and

WHEREAS, The American Consuls are at present doing excellent service in reporting upon the conditions and opportunities that exist abroad in other leading lines and are in a position to secure much valuable information on the subject of Export Markets for American Cotton Goods, therefore:

Be it Resolved, that the Secretary of this Association be requested to communicate with the Department of State to the end that suitable instruction may be issued to the Consular Officials of the United States in all foreign countries requesting them to secure all the available information regarding the possible markets for American Cotton Goods of all descriptions, including yarns, that may exist in their respective districts, together with such samples, price lists and other material as may be of practical utility to the members of this Association.

On motion of Mr. ARTHUR H. LOWE, seconded by Mr. NATHANIEL B. KERR, it was voted that the motion be adopted.

The PRESIDENT. Ladies and gentlemen, it is now my pleasure and my privilege to introduce to you one who has so kindly and so generously come forward to bid us welcome to the Berkshires, one I need hardly say of the foremost citizens and leading industrial captains of New England and whose presence on this occasion lends character, dignity and added interest to the proceedings of this Convention, the Honorable WILLIAM B. PLUNKETT.

WELCOME TO THE BERKSHIRES.

HON. WILLIAM B. PLUNKETT, Adams. Mass.

Mr. President, ladies, gentlemen of the New England Cotton Manufacturers' Association and guests: It is a happy and most agreeable privilege that falls to my lot this morning. The honored Secretary in writing me to address a few words to this distinguished body conferred an honor of which I am justly proud. In compliance, therewith, it is my special pleasure to extend to you a most cordial welcome to this beautiful town of Lenox and to the Berkshire Hills.

Should anyone question my perogative as a non-resident of Lenox to extend to you these welcoming words, I have to say that my father who was one of the pioneers of Berkshire County in cotton manufacturing was a son of Lenox, thus, you see, it is as a grandson I greet you and bid you welcome.

Lenox, you know, is famed throughout the land for its brilliant social atmosphere, its magnificent cottages, this fine hotel with an ideal host, its beauties of nature, at this season rich in tints of autumnal foliage. Prominent people from all parts of the United States come to Lenox and I am proud to say that no less in importance, prominence, ability and high personal character is this splendid assembledge of men, the ladies who accompany you of course included, to whom we now accord the welcome of heart, hand and voice.

Lenox, as an inland town, is an ideal place for a convention of this character for while those interested in cotton manufacture meet to express friendly greetings and opinions, engage in discussion, the ladies, who, I am glad to know have come in

such goodly numbers, will enjoy to the utmost this Newport of the Berkshire Hills as it is sometimes termed.

I trust that this meeting in determining and paving the way for full and fair adjustment of the difficulties that confront us as cotton manufacturers will be productive of the highest goods. To this end may the fragrant and inspiring ozone of the Berkshires lend cheering and invigorating aid. [Applause.]

PRESIDENT'S ADDRESS.

HERBERT E. WALMSLEY, New Bedford, Mass.

Gentlemen of the New England Cotton Manufacturers' Association, ladies and gentlemen : In rising to address this convention, I deem it fit and proper that my first words should be an expression of my appreciation of the honor conferred upon me by the Association in electing me its chief executive at the annual meeting held in the City of Boston last April; permit me further to say that I esteem it a distinction worthy the ambition of every member of the Association.

As you are aware, our Association is distinctly and peculiarly representative of the great cotton manufacturing industry, an industry representing, on the one hand, a vast amount of money invested in cotton manufacturing establishments — some five hundred million dollars, with all that this implies — and, on the other hand, finding employment for many thousands of families, for so many thousands of our fellow human beings, whose daily bread depends upon the successful conduct and operation of this great industry.

Realizing, therefore, as we all of us must, the true significance of our organization as a responsible body, as a living and important factor in the prosperity and development of these vast interests, it is apparent that it is the plain duty of every member of the Association to see to it — so far as in him lies — that the Association be fully maintained in its entirety, and further, to endeavor, by every legitimate means, to increase the scope, the influence, and the power of the Association, in which we all of us, individually and collectively, have one common interest;

and, whilst it is matter for congratulation that the Association has reached its present position, commanding as it does the attention and respect of so large a portion of the active, industrial, and commercial world, it has become increasingly necessary to put forth, with vigor and determination, new efforts with the object of continuing our existance on a plain commensurate with our importance and usefulness.

The Board of Government, therefore, extends a hearty and earnest invitation to the younger members to come to the front, and side by side with the older members assume their share of the work of the Association.

Suffice it to say that the Association needs — as all like associations need — the hearty and unstinted co-operation of each and all its members to enable it to carry on successfully the work to which it is committed.

In this connection I venture to emphasize the fact that resting upon every member of the Association is the duty of helping forward this work.

I take this opportunity and, at the same time, it affords me infinite pleasure to acknowledge the debt the Association owes its Secretary and Treasurer — Mr. WOODBURY — for the painstaking, conscientious, and thorough work he has done in the past, and is doing today, in the interests of the Association; he will pardon me if I say that to him, perhaps more than to any other individual man, belongs the credit of having brought the Association to its present standing. In this I feel sure of the generous assent of all who have been active in the work and in the councils of the Association.

Gentlemen! the unsatisfactory condition of the cotton trade at the present time is unfortunate and regretable, business being confined today — as it has been for several months past — to absolute requirements; the past few months have been one of the most difficult periods we have prehaps ever experienced; the prevailing quietude in the trade has undoubtedly been intensified by the raw material situation.

It appears to me that what has created possibly the greatest

difficulty has not been so much the cessation in the supply of the raw material itself, but the temporary cessation of that supply coupled with the speculative manipulation we have lately witnessed.

It has been a physical impossibility to buy what cotton there was available at prices that would permit the manufacture of the raw material, only at absolute loss to the manufacturer.

The prosperity of the cotton trade must, in my judgment, be dependent primarily upon a cotton crop sufficiently large for the world's requiremetns, and a crop of sufficient magnitude to make it too risky and dangerous a proposition for the speculators' greed.

It is a deplorable circumstance that the pernicious practice of cornering such a necessary staple as cotton should be possible, demoralizing and paralyzing, for the time being, an industry of such immense wealth to individuals and to the Nation as that of cotton manufacturing, throwing out of employment, and reducing to the verge of starvation the thousands of families whose very existence is dependent upon the continued and steady operation of the factories where they find employment.

The baneful influence of this speculative manipulation of cotton is a matter for serious concern, involving consequences of an injurious kind to so large a part of the community and the public collectively, and for which there can be no justification whatsoever.

The force of these considerations should surely be sufficient to justify some concerted and united action towards putting a stop to the gambling operations which inflict such widespread suffering and injury upon so many and such important interests.

It will be a boon of inestimable value to the entire manufacturing world when the efforts now being made to grow cotton in other countries in sufficient quantity and of the required staple are successful, as undoubtedly in the course of time they will be.

It must be recollected, however, that it will in all probability take some years before the results can be counted upon as a

practical factor in the situation; meanwhile it devolves upon every man connected with the cotton trade to make emphatic protest and seriously consider every proposal with the object of putting an end once for all to the vicious and unhealthy practice referred to.

At a time like the present, when the effects of Southern competition are being prominently brought into notice, the necessity surely exists for determined and emphatic protest against the unduly long hours worked in the Southern cotton mills; every possible influence should be brought to bear with the object of securing a more nearly uniform and maximum "labor-day" both North and South.

It is beyond question that any increase in the number of hours of labor beyond that maximum is bad in its effects on the quality as well as on the quantity of the output, besides being admittedly injurious upon the physique, and general health of the operatives.

Well aware, as we all of us doubtless are, of the difficulties surrounding the question of interference in this matter, some authorative form of intervention is surely legitimate and justifiable.

In this connection the point I desire to lay stress upon is that intervention is legitimate where the well-being and interests of others are injuriously affected, as in this particular, and where intervention would be useful and beneficial all round. We are convinced beyond peradventure that, in the natural order of things, and in due course, the hours of labor in the Southern cotton mills will be reduced precisely as they have been in New England and elsewhere; this is as certain as it is certain that the sun shines; it does not follow, however, that we should remain passive, and sit quietly by awaiting the advent of that time.

I do not believe in the man who recognizes an evil, denounces it, and wishes that evil removed, and yet will not raise a little finger to help remove it.

Let it not for a moment be imagined that we in the North fear or are jealous of Southern competition on legitimate lines;

on the contrary we warmly congratulate the South on the great development of its natural and industrial resources.

We know of no divine right by which the North can claim a monopoly in the manufacture of cotton goods; there is surely ample room for both North and South both at home and in competition with the old world in the densely populated countries of the far East, in Africa, and other neutral markets.

The supremacy of cotton manufacturing in New England is not, in my opinion, in jeopardy; it is and will continue to be unassailable.

It is as firmly established and as impregnable as the Rock of Gibralter, and whilst we cannot prudently ignore Southern competition, there is no need for hysteria or alarm; it is simply history repeating itself.

The competition and the increasing competition of the modern mill with the mill of old time structure and equipment is the problem to be solved by the older mills, and it is being solved, and will continue to be solved correctly, and in the only way, by the men who are today confronted with that problem.

It has been my privilege within a very recent period to inspect two or three mills of the very latest and most approved construction: the guiding and leading principle in the construction and building of these mills, and in their equipment, in fact, in their every detail from foundation to roof has evidently been the securing of the very best that human ingenuity and past experience could design and devise, and in this they have succeeded perhaps beyond expectation.

Further, the quality of the yarns and cloths being made in these self-same mills is of the highest character and excellence from the raw cotton to the woven fabric, it being clearly apparent and self evident that the managers and executive heads of these corporations fully realize that their future success depends upon the superiority of their out-put, appreciating as they undoubtedly do the fact that quality carries with it quantity and economy, and further commands both preference and higher or better prices in the open market, leaving others to compete for

the poorer and cheaper grades of goods where competition is keener and margins are closer. These men, in my judgment, have read aright the signs of the times, and, grasping the situation as they correctly have done, will undoubtedly in time reap the reward of their foresight and sagacity, and for which they are to be commended and their stockholders congratulated.

I have purposely laid stress upon this particular point, being convinced, as I ever have been and ever shall be, of the vital importance of thoroughness and true excellence in its fullest sense and in every particular.

The financial strength and stability of our corporations, the quality of originality, the exercise of economy, eternal vigilance, and the executive ability and experience of the Northern mill man are a guarantee of a permanent strengthening of our position generally.

Personally, I have no misgivings as to the future of the cotton industry of New England.

One of the distinguishing characteristics of the present day is the rapid progress being made in almost every branch of industry; the rapid productive growth in the manufacture of cotton goods alone is much beyond what any natural growth in home trade would warrant, and must find its justification in a liberal extension of the export trade in cotton goods; the marked increase in American exports to China, the opening up of new markets in Cuba, Porto Rico, and the Philippines furnish wider outlets; nevertheless, close attention to and intelligent cultivation of still other fields will be necessary if the evil of over-production is to be avoided. Naturally when trade is good there is a tendency to extend and rapidly overtake the demand by increased production; we should not, however, consume ourselves by unreasonable competition within our own borders.

By the very necessities of our industrial and commercial expansion, increased opportunities and markets which present the greatest field for our manufactured products, and especially for the sale of our over-production, must be steadily and persistently cultivated.

If I am correct, the population of this country doubled itself during the last 33 years, and now numbers some 80,000,000 people; if we continue to increase in like ratio, the population say 33 years hence should be 160,000,000.

This is matter for congratulation and hope for the future, if we put intelligence into our work with the courage and perseverance of the Anglo Saxon race.

The contest among the nations in the future, if not already upon us, will be for industrial and commercial supremacy.

America today holds a foremost place in the struggle, and American activity and enterprise are destined to conquer the trade of the world.

It is important to observe, and I take it perfectly proper to emphasize the fact that the pronounced and marked improvement and advance made in the character and quality of the cotton goods manufactured at the present time is largely the outcome of improved machinery.

The productive power of cotton machinery has made and will, I believe, continue to make considerable progress, chiefly through the persistent efforts and increased skill of our ingenious machinists, which is ever being urged on by the keen and ever increasing competition in the cotton trade to make the machinery as automatic as possible, and at the same time to increase its productive power for quality combined with quantity.

Many improvements in the construction of cotton machinery—notably in power looms — have lately been brought forward, and some of them appear to have important advantages over any other construction that has hitherto been in use; their real value, however, can only be determined by time and experience.

It should be recollected in this connection that thousands of ingenious contrivances have been laid aside before cotton manufacturing machinery was brought to its present state of perfection; nevertheless, the enormous growth of our textile industries has to a large extent been made possible only by the aid of new inventions, and the striking advance and improvement in textile machinery.

For this the machinery builders deserve and are entitled to both recognition and credit.

A word with reference to the technical education movement: We are told that among the many causes that have contributed to the advancement of German industry are the educational conditions upon which Germany has relied so largely in the past for the maintenance and remarkable development of her industrial progress.

The importance of technical education is fully understood in this country; nevertheless, we must see to it that neither Germany nor any other country surpass us in this particular, never losing sight of the fact that the continuance of our prosperous existence as an industrial and commercial people depends upon our ability to compete in the great markets of the world with our European rivals.

We cannot live without exchanging the work of our hands and the thought of our brains with those of other nations.

If they surpass us in intelligence, we shall become poor and incapable in comparison with them.

Excellent work is being accomplished by our textile schools, and must form one of the chief elements of our success in commercial and industrial prosperity.

Regarded from the economic or industrial point of view, how important then is the question of technical education; that this sentiment has taken possession of the people of this great and rapidly evolving country is manifested by the readiness and munificence with which either as individuals or as communities they establish, throughout the length and breadth of the land, agencies whose functions shall be the industrial enlightenment and artistic training of its citizens.

There must be no disposition to remain satisfied with past or present achievements.

The wisdom of appropriating from the public funds such moneys as may by the authorities be deemed proper and sufficient for the encouragement of the technical instruction movement can scarcely be questioned or criticised.

Gentlemen, it is no part of the design of my address to make any unwarrantable tax upon your attention by plunging into abstract speculation on the economic problems affecting modern industrialism; still, in passing, I venture with all respect to submit that such a vexed question for instance as industrial unity, and again the question of the so-called trusts are perfectly legitimate topics for investigation, consideration, and discussion by this Association.

As regards the former — industrial unity, capital and labor, employer and employed, or call it what you will — let us at least be enlightened, brave, and humane enough to endeavor to discuss it calmly and impassionately.

From the standpoint of either employer or employed, it is admittedly difficult to assume an unbiassed and unprejudiced attitude in connection with it.

We all of us doubtless fully realize how delicate a matter it is to deal with such a subject as the relations between employer and employed; one runs the risk of offending the former, and, as regards the latter they are perhaps naturally suspicious of a manifestation of regard from one not of their own ranks, and are apt to think one has some purpose of one's own to serve.

In this connection, however, I venture to affirm that the great majority of employers in their relations with the employed are animated by the desire for the betterment and amelioration of the lot of the vast masses of toilers whose daily lives are spent in the busy hives of industry now so widely dotted over the face of this vast continent; let us hope this will ever be the universal object of human desire.

It is not my purpose on this occasion to enter into any controversy, or to say anything that might be construed as illwill in connection with trades unions as such; there is, however, one most important phase of the question of employer and employed which I trust I may with propriety refer to, and upon which, I take it, there can be no two opinions from the employer's standpoint, and with which opinion the employees should coincide, and must conform to. I refer to the management and direction of our industrial corporations.

The managers alone must manage and direct the great interests they are intrusted with, and for which they alone are responsible, without any outside interference whatsoever; there can and must be no co-partnership in this respect, and it is important that this position be clearly defined and distinctly understood.

The question of industrial combination, or co-operative amalgamation, is one of deep significance and engrossing interest as affecting the general welfare, and about which every one doubtless has his own notion; the subject of these gigantic trusts is an awkward one but, nevertheless, should not, in my judgment, be evaded on that account.

Personally, I do not regard these so-called monopolies as necessarily harmful to the mass of the people if conceived, financed and managed upon recognized sound principles and methods.

If, on the other hand, they are promoted to promote the little interests of one little order of men, they undoubtedly hurt the interests of all other orders of men; but again, and this is a very important point, it may be that these big combinations place us in a stronger position and more able to compete with and beat down other countries in the commercial struggle, and, if so, may be regarded here as perfectly legitimate.

One naturally learns as one gains wider knowledge to be guarded in one's utterances on these complex problems, nevertheless, we cannot escape them if we would; occupying and agitating, as they do, the minds of all thoughtful and thinking men, permit me to add that I trust they will, in the future, receive at the hands of this Association the consideration their importance demands.

The universal tendency to move, to advance, and to grow with the natural progress of a vast and prosperous country, a country rich in all the resources of nature, and free in all her institutions, combined with the impulse of an energetic and indomitable national genious, ought to keep the United States of America ever in advance of the never ending duty of achieving a higher civilization.

I conclude my reflections with the hope that the proceedings of this convention may prove interesting, instructive, and of value, not only to those assembled here, but in due course to every member of the Association, and I further trust that when our meeting here is referred to it may be such as will be worthy of that reference.

The following papers were read:

The Influence of Electricity on the Developmeht of Water Powers,
FREDERIC A. C. PERRINE, D. Sc., Pittsfield, Mass.

Discussed by Messrs. JOSEPH MERRIAM, ARTHUR H. LOWE, FRANK P. SHELDON and CHARLES T. MAIN.

Storage Battery Locomotives for Mill Yards,
EDGAR H. BERRY, New Brighton, N. Y.

Discussed by Messrs. THOMAS HENRY SMITH and EDWARD ATKINSON.

Reminiscences,
EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

Discussed by Mr. C. J. H. WOODBURY.

The PRESIDENT. May I ask if the committee on ballots is ready to report.

Mr. JAMES P. TOLMAN. Mr. HALL, the chairman, being absent from the room, I, as second member of the committee, present the report; there were 33 ballots cast on the amendment to the Constitutution, of these 31 ballots were yes, and 2 were blank.

The PRESIDENT. Gentlemen, the amendment is adopted and forms part of the Constitution and By-Laws of the Association.

The session now stands adjourned until 8.15 this evening.

SECOND SESSION.

WEDNESDAY EVENING, SEPTEMBER 30, 1903.

Meeting called to order at 8. 15 P. M., President WALMSLEY in the chair.

Mr. EDWARD ATKINSON. Mr. President, in regard to the resolutions asking the Secretary of State to direct the United States consuls to procure information relative to possible foreign markets for American cotton goods, it is essential in order to secure any efficient service from such a measure that the copy of the resolution should be accompanied by specific queries which could readily be made the basis of a circular of instructions by the State Department at Washington.

The PRESIDENT. I think, sir, that your suggestions are correct and I take it that the proper course would be to lay them before the Board of Government for such action as it may see fit to take in drawing up such a letter to the Department of State.

The following papers were read:

Waxes in Warp Sizing,
DANIEL MOORE BATES, Wilmington, Del.

Discussed by Mr. JOHN F. HAMLET.

Bobbin Filling; Its Tendency to Kink,
JOHN GREGSON, Fiskdale, Mass.

Discussed by Mr. GEORGE OTIS DRAPER.

Gambling in Cotton,
JOSEPH D. AIKEN, Taftville, Conn.

Discussed by Mr. HENRY G. KITTREDGE.

An Improvement in Cards,
WILLIAM HAYES, Auburn, Maine.

Discussed by Mr. ARTHUR H. GULLIVER.

THIRD SESSION.

THURSDAY AFTERNOON, OCTOBER 1, 1903.

This session was devoted, as the guests of the Stanley Electric Manufacturing Company, to an excursion to their works at Pittsfield.

While the men were visiting this establishment, which was hospitably thrown open to an inspection by the party, divided in small groups, each under the leadership of an intelligent guide, the ladies were taken on a trolley ride to Cheshire.

FOURTH SESSION.

THURSDAY EVENING, OCTOBER 1, 1903.

Meeting called to order at 8.15 P. M., President WALMSLEY in the chair.

The following papers were read:

Advantages of Steam Turbines for Textile Mills,
AUSTIN R. DODGE, Schenectady, N. Y.

Discussed by Messrs. C. J. H. WOODBURY and CHARLES T. MAIN.

The SECRETARY. Mr. President, I have several matters of business to introduce, one of which is the pleasant privilege of reading a letter of congratulation and best wishes for the success of this meeting from Mr. C. B. BRYANT, Secretary and Treasurer of the American Cotton Manufacturers' Association, Charlotte, N, C., and also a telegram from Ex-President FISH who is unable to be present, giving his best wishes to his successor, and to the members.

We did not have an opportunity to have before this meeting a paper on the fibre spools but Mr. BUZZELL has brought some of the spools here which he will show to any of the members after the meeting.

The President of the Association submitted a communication which I am to read, at the last meeting of the Board of Government which deferred any action upon it owing to the absence of

the President and postponed the matter out of respect to him but will take it up later. It is a matter of importance which it is believed should have the consideration of the members of the Association and the proposition is this:

This is submitted for the files, and the Board of Government do not ask for any action at the present time, but they do desire the personal consideration of its suggestion by the members:

The Board of Government, realizing that the reading of very dry technical papers — which cannot be readily comprehended without a chance to study them — are and must of necessity be dull and uninteresting to many, if not most of the members, have, therefore, taken under consideration the plan of selecting three or four important subjects, picking out men who can deal with them in the most intelligent way: notifying them at once of their selection with the understanding that their papers will be sent in, say, six weeks before the meeting and with the further understanding that they are not to be read at the meeting but are to be made the subject of intelligent discussion on the first day and to be exhausted before any other subject is taken up. This, it is believed, will economize time now spread over too many subjects and will also do away with discussions without much point.

The second day to be devoted to the introduction of new inventions, processes or methods.

It is also felt that the annual meetings had better be held in the rooms of the Massachusetts Institute of Technology where papers can be illustrated or mechanism can be put in operation, and where the surroundings will all be consistent with the purpose of the Association.

If this plan can be successfully carried out, it is hoped that it will stimulate interest in the work of the Association, and the Board of Government, therefore, invites an expression of opinion in writing from every member of the Association with reference thereto.

All communications to be addressed to the Secretary.

HERBERT E. WALMSLEY, *President.*

It is hoped as a result of this that the Secretary will receive in the near future, for submitting to the Board of Government, suggestions from the members in regard to this point as suggestions from members are always welcome at the headquarters of the Association. Suggestions are frequently made, they are never ignored; if they are not carried out it is because a concensus of opinion does not agree with the suggestion, or, that it is not feasible on account of those conditions, generally those of expense. It should be remembered that this Association is conducted on lower dues than any similar organization, and the utmost economy is essential in the management of its affairs.

This Association is just what its members make it, and not what its officers do; the stream does not rise higher than its head, and it is to the members that the officers look for co-operation, suggestion and inspiration.

The SECRETARY. Mr. President, I am requested to submit the following resolutions to the meeting:

Resolved. That the thanks of this Association are due to Mr. HENRY J. BALLOU for the delightful manner in which he and his associates at the entertainment on Tuesday evening shook out the kinks in our chains of life and made them longer.

In remembrance of the many pleasant experiences of this trip we wish to make this acknowledgment of Hotel Aspinwall as enhancing the attractions of Lenox, the many attentions of the management of the hotel and especially to Mr. O. D. SEAVEY for his courtesies, especially in securing for the members of the party the privilege of visiting several of the beautiful estates in the neighborhood.

To the STANLEY ELECTRIC MANUFACTURING COMPANY for their hospitality in providing for the trip to their works and for the privilege of examining the process of manufacture of electrical apparatus for the transmission of power which is such an important feature in these enterprises in which the members of this Association are directly interested.

To the Honorable WILLIAM B. PLUNKETT for his hospitable welcome to the Berkshires.

To Dr. F. A. C. PERRINE for his suggestive and thoughtful address on the Influence of Electricity on the Development of Water Powers.

To Mr. EDGAR H. BERRY for his interesting paper giving some of the latest methods in treating the important problem of mill yard transportation.

To Mr. AUSTIN R. DODGE for his able exposition of some of the most recent developments in the application of steam power to textile mills in which work he has taken such an important part.

To the COMMITTEE ON MEETING, especially to its chairman for the courteous services which added so much to the success of the occasion and the pleasure of the members of the party.

To Mr. HENRY W. KITTRIDGE for his contribution on the subject of anticipated prices of cotton.

On motion of Mr. HENRY B. SPRAGUE, seconded by Mr. JOSEPH D. AIKEN, it was unanimously voted that the resolutions be adopted and that the Secretary be instructed to transmit a copy to each of the parties interested.

Mrs. WARREN BREED. Mr. President, and gentlemen. The lady guests of the Association beg the priviledge of participating in this evening's session for the purpose of presenting an expression of thanks to President WALMSLEY for his many attentions, especially for the gift of the souvenir boxes and flowers, and they echo the sentiment expressed by the gentlemen, that, "He is the finest President *we* have ever had."

The SECRETARY. Under the circumstances it is the Secretary's priviledge to put the question for the adoption of the resolution. Those in favor, please say, Ay, contrary minded, No. It is adopted by a unanimous vote.

The PRESIDENT. There are occasions in the lives of most men when power of speech is as it were paralyzed by their feelings. I was called upon some little while ago to address an audience, the subject being the technical instruction movement and knowing that my audience was inclined to be somewhat critical I endeavored to memorize my remarks: when I got

about half way through and glancing around seeing so many ladies, I thought it would not be ingracious in me to make some reference to their presence. I immediately forgot all that I intended to say about technical education and I forgot what I wished to say to the ladies. My friends advised me never again to attempt any address where there were ladies present.

I shall carry away with me from this Berkshire Meeting as one of the most delightful remembrances of the meeting the kindly sentiment that the ladies have expressed.

The following papers were read:

Mud Fuel,
EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

Blending of Cotton,
DANIEL CLARK, Frankford, Philadelphia, Pa.

Adjustment of Preparing and Spinning Machinery.
EBEN C. WILLEY, Boston, Mass.

Discussed by HERBERT E. WALMSLEY.

The SECRETARY. The Board of Government submits with their approval, the following names of candidates for membership.

FOR ACTIVE MEMBERSHIP.

CHARLES E. CHILDS, Treas., Hampton Co., Asst. Treas., West Boylston Co., Northampton, Mass.
By Mr. GEORGE A. AYER.

MARK B. CREED, Supt. Nos. 1, 2 & 3 Wamsutta Mills, New Bedford, Mass.
By Mr. HERBERT E. WALMSLEY.

JOHN H. DUNN, Supt. Tremont & Suffolk Mills, Lowell, Mass.
By Mr. J. J. CONNELL.

HENRY J. FORSYTH, Supt. The Sibley Mfg. Co., Augusta, Ga.
By Mr. JOHN W. CHAFEE.

WALTER R. GARSED, Mgr. Wingohocking Cotton Mills, Frankford, Philadelphia, Pa.
By Mr. J. R. MONTGOMERY.

E. STANLEY GARY, Vice-Pres. & Gen. Mgr. Gary Mfg. Co., 108 West German St., Baltimore, Md.
By Mr. JAMES A. GARY.

FREDERICK STUART GREENE, Mgr. Transmission Rope Dept., The American Mfg. Co., 65 Wall St., New York City.
By Mr. GEORGE F. WHITTEN.

JAMES HENRY, Thos. Henry & Sons, Trenton Ave. & Tioga St., Philadelphia, Pa.
By Mr. ROBERT BEATTY.

WILLIAM G. HENRY, Thos. Henry & Sons, Trenton Ave. & Tioga St., Philadelphia, Pa.
By Mr. ROBERT BEATTY.

HIRAM HIGHAM, Supt. Nos. 6 & 7 Wamsutta Mills, New Bedford, Mass.
By Mr. HERBERT E. WALMSLEY.

LEONARD JOHNSON, Supt. Wampanoag Mills, 33 Cambridge St., Fall River, Mass.
By Mr. WILLIAM EVANS.

RONALD T. LYMAN, Asst. Treas. Boston Mfg. Co., P. O. Box 1717, Boston, Mass.
By Mr. ARTHUR H. GULLIVER.

ALEXANDER MAKEPEACE, Supt. Richard Borden Mfg. Co., Fall River, Mass.
By Mr. RICHARD B. BORDEN.

JOHN G. MCFADDEN, Supt. Nottingham Mill, 314 Dyer St., Providence, R. I.
By Mr. HARRY K. DREW.

WALTER H. PAIGE, Supt. Wamsutta Mills, New Bedford, Mass.
By Mr. HERBERT E. WALMSLEY.

WILLIAM C. PLUNKETT, Mgr. W. C. Plunkett & Sons, Adams, Mass.
By Mr. CHARLES T. PLUNKETT.

LAVATER W. POWERS, Supt. Bristol Mfg. Co., 141 Merrimac St., New Bedford, Mass.
By Mr. GEORGE A. AYER.

ALBERT E. SCHOFIELD, Delph Spinning Co., Clearfield & C. Sts., Philadelphia, Pa.
By Mr. ROBERT BEATTY.

SAMUEL TAYLOR, Supt. Soule Mill, New Bedford, Mass.
By Mr. HERBERT E. WALMSLEY.

BERTON A. THISSELL, Supt. Boott Cotton Mills, Lowell, Mass.
By Mr. ARIEL C. THOMAS.

WILLIAM T. WESTERMAN, Mgr. Ontario Spinning Co., 1729 Philip St., Philadelphia, Pa.
By Mr. ROBERT BEATTY.

PAUL WHITIN, Asst. Treas. Paul Whitin Mfg. Co., Northbridge, Mass.
By Mr. H. T. WHITIN.

LEWIS J. YOUNG, Supt. Gault Mills of Montreal Cotton Co., Lock Box 240, Valleyfield, P. Q., Canada.
By Mr. ERNEST E. CLARKE.

FOR ASSOCIATE MEMBERSHIP.

CHARLES B. BURLEIGH, Textile Power Dept., General Electric Co., 84 State St., Boston, Mass.
By Mr. GEORGE P. GRANT, Jr.

JOHN HENRY ENGLISH, English-Greene Co., 26 Fountain St., Providence, R. I.
By Mr. FRED A. WILDE.

VLADIMIR F. GNESIN, Sole Agt. of the Great Yaroslavl Mfg. Co., Moscow, Russia, 68 Broad St., New York City.

JOSEPH C. KING, Ring Travelers, 133 Essex St., Boston, Mass.
By Mr. HENRY B. SPRAGUE.

MR. ARTHUR H. LOWE. I move that the Secretary cast one collective ballot on behalf of the whole Association.

The PRESIDENT. Moved and seconded that the Secretary be instructed to cast one ballot in favor of the election of the new members. Those in favor please say Aye, contrary? It is an unanimous vote.

The SECRETARY. Mr. President, this is my ballot.

The PRESIDENT. I, therefore, declare they are elected.

The PRESIDENT. I, now, gentlemen, declare the convention adjourned. [Applause.]

Adjourned at 9.40 P. M.

Attest:

C. J. H. WOODBURY,
Secretary.

TRANSACTIONS.

FIRST SESSION.

WEDNESDAY MORNING, SEPTEMBER 30, 1903.

The Association met in the Music Room of Hotel Aspinwall, Lenox, Mass., at 9 A. M., President WALMSLEY in the chair.

The PRESIDENT. Gentlemen, the title of the first paper to be presented is the Influence of Electricity on the Developmen- of Water Powers by Dr. F. A. C. PERRINE of Pittsfield. I unt derstand that Dr. PERRINE is one of the ablest exponents of this subject and I trust you will give the attention the subject demands.

Dr. F. A. C. PERRINE. Mr. President and gentlemen of the New England Cotton Manufacturers' Association. When your Secretary asked me to address you with a paper I felt greatly honored and hoped that as an electrical man I might be able to have something to say to the cotton manufacturers which might be of interest to them. I know full well that they have been talked to by engineers of the manufacturing companies in regard to motor drives to cotton mills and I felt there was nothing I could say there that would interest you at this time.

In my experience I have found there are cardinal principles

made use of in the West that are not made use of in the East and so much so that wherever I have gone in New England during the past four or five years, during the time I have lived here, I have been considerably impressed with the development of water power and this has seemed to me too good an opportunity to miss of presenting what I have thought about this matter before a body of men who are competent to judge. I suppose there is no body who know more about water powers in the country than the New England Cotton Manufacturers' Association, they know their good points and know their bad and have developed them in all possible ways.

Accordingly, I trust that you will bear with me if I dwell too much on what you already know and I hope that as a whole I will present some ideas that may seem worthy consideration.

THE INFLUENCE OF ELECTRICITY ON THE DEVELOPMENT OF WATER POWERS.

F. A. C. PERRINE, D. Sc., Pittsfield, Mass.

In the midst of a country where there is already so much water power in constant use and before the New England Cotton Manufacturers' Association, a body of men who have done more than any other one body in establishing the commercial importance of water powers, it may seem presumptuous for an electrician to attempt to call attention to neglected opportunities or to suggest new ideas concerning methods of development. It is not, however, with the idea of presenting a paper of great originality, but rather on account of your familiarity with the subject that I venture to call your attention to what has been done and to recall to your minds what has already been said on this subject, and with this which has been done and said in view to attempt to point out certain unconsidered trifles which if now considered may ceasing to be trifles become important elements in the future to produce a better and more satisfactory development of water powers. Whether the ideas are novel or not matters little since in the past the proper development which I wish to advocate here has been quite obviously overlooked. Perhaps it may be objected that it is not quite correct to charge that the advantageous plans advocated have been overlooked, for during the period in which most of the water

powers of New England were developed, the means were not available for development in accordance with the writers's present ideas; but since the introduction of electrical transmission and electrical machine drives there is no further reason for many of the installations which are now being carried out.

In order to explain more clearly what is meant, it is only necessary to call attention to water power development anywhere and everywhere in this region. Anywhere and everywhere throughout this region there are valuable power streams along which the rapid fall of the stream bed allows developments with heads of from ten to forty feet at mill sites situated in distance from each other of from half a mile to five miles. The mills using these have characteristically each a dam, a pond, and generally an auxiliary steam plant. This steam plant is useful not only when the water is insufficient but also in operating the mills down stream on summer mornings when the water in the ponds above has not yet reached its natural channel; though when once the flow has been established there is sufficient water for the operation of the mills, and during the majority of the working hours the steam plant is cut off.

Many of the mills so described have been located on account of the availability of the valuable water power and are today operating under great disadvantages from their inaccessibility, rendering necessary a heavy teaming bill for the haulage of raw material, finished product and coal. They are compelled to maintain extensive tenement districts in order to obtain operatives, though perhaps located within a short distance of a mill town or populous region. And, furthermore, in order to permit an arrangement of the mill which will connect the machinery properly to the water wheel, it frequently happens that they are located at sites entailing expensive original construction and unsatisfactory internal arrangements; besides the location along the streams often gives rise to great repair bills in times of flood, and finally, in such locations neither mills nor tenements are properly situated with reference to the best sanitary conditions.

The question of the applicability of electrical machinery in cotton mill work is undoubtedly not pertinent to this discussion as I think you are all agreed that there are economies which can be affected in mill design and operation by the use of electrical motors and that the experience of the past ten years has proven that electrical machinery applied to cotton mill working improves to a very considerable extent the quality of the product. It is, however, in this discussion necessary to call your attention to the fact that the improved quality of the product, whatever it may be, is largely on account of the fact that the motor tends to operate in synchronism with the speed of the dynamo, and in consequence this advantage, which may be considered as attached to the motor drive, is only present when the motor is driven by a large constant speed dynamo. With the same water wheel driving a mill through the agency of a belt or through the agency of motors, there is probably comparatively little advantage in the use of the motor although, even in this case, the irregularity of the slip of belts can be obviated.

It is, however, particularly pertinent to this discussion to consider the question of the value of water power as such, and it is not sufficient to simply state that the value of the water power is already well recognized by the mill owners, for, however, true the statement, it is at best only a general one while we need here a more specific statement of estimate of value. Consulting engineers are in the habit of estimating water powers solely on the basis of the amount of power which is available for 365 days in the year, of 24 hours for each day. Perhaps they are wise in so estimating, as the mistakes they may make in underestimating the usefulness of the water power are very often counterbalanced by the mistakes they are also making in the cost of its development and the possibilities of the market. But, however advisable it may be for the consulting engineer to neglect altogether the variable power a river is capable of furnishing, it is necessary in this discussion for us to consider the limits of variability which one should allow for development of a water power.

As has already been stated New England mills are equipped

with both steam and water power and there is probably no body of men in the country more familiar with variable water power than this. Water powers not continuous require an equivalent steam power equipment of engines, boilers and men, with full interest charges, and in consequence such powers only effect a saving equivalent to the fuel consumption of the steam engine. This, with continuous power and coal at the average New England price, amounts to approximately $36.00 per year and in consequence it is not reasonable to contemplate the development of excess power beyond the continuous flow of the stream where the generation of the excess power involves capital and operation charges exceeding $36.00 per year. Furthermore, I do not consider that it is safe to estimate that this means that one should expend as much as six hundred dollars per horse power for the development of excess power. Since a cotton mill organization which can only net six per cent. on the investment which it has made for machinery and equipment had better use its money in a banking business and go out of manufacturing. In fact, it is my opinion that it is unwise to develop the variable power of a river where the expenditure for this portion of the developing exceeds on the basis of twelve months supply of power $200 per horse power, or, in other words, $100 per horse power for six months power, or about $150 per horse power for nine months power. I am confidently of the opinion that it is economical to develop the variable power, where the continuous power does not exceed in cost $300 per horse power and the variable power does not exceed $200 per horse power, based upon a continuous rate.

A statement has been made, and I believe that such a statement is hard to disprove, that the development for continuous power at a cost not exceeding $300 per horse power produces energy at a rate with which steam plants cannot compete successfully, no matter what the cost of fuel, and I am further of the opinion that where the excess power for a development does not cost more than $200 per horse power it more than pays for the saving in fuel alone, and that this condition warrants the

development of this excess power and the installation of a steam plant to be operated only during the time of the deficiency of water. As these opinions may not be easily justified in the installation of the plants having less than 1,000 horse power minimum capacity and as the majority of mills and water powers to which the argument might apply are of less capacity than this, it may, at first sight, seem that the arguments which have been presented have no particular or general interest; but before you hastily arrive at this conclusion, I beg to call your attention to the fact that I have already stated and hold that as the business of a banker is not, in my opinion, legitimate business for a cotton mill, I hold, reasoning along the same lines, that the development, generation and distribution of power is no more the business of a cotton mill than making investments of a banking character would be.

Certainly it is true that cotton mills have been built up along the water powers of New England, but as a consequence we find everywhere wasteful and expensive development of power, a lack of proper railroad facilities and a general disregard for manufacturing convenience in consequence of a choice of site rendered necessary by the domination of the needs of past methods of water power development. The idea that I would bring forward is that of the centralized plant, developing power for the use of many cotton mills; as I believe that the manufacture of the power should not be considered one of the provinces of a cotton mill superintendent. In many cases, this means the purchase of power from an altogether independent concern from the mill itself, though in many cases I hope in the future to see central power plants owned by the cotton mills, precisely as they own their insurance companies today, with a separate and efficient management and with a common interest and aim.

It may be seen then that what I am intending to advocate is the complete development of the water powers in large units and not in small units, with auxiliary central steam plants, permitting at all times the distribution of constant power to the mills and the consequent location of the mill in reference to their product

and operatives and not in reference to the power. In order to do this it is necessary to abandon the contemplation of small developments of individual falls and to substitute therefor the unification of many falls into one high head power wherever this can be accomplished by the means of flumes or dams. Whether this shall be done by the individual mills or a separate water power company owned by the mills is a question for each individual case. Generally in sections thickly covered by mills and intersected by power streams there is no doubt but what the central plant can easily utilize and concentrate all powers within a radius of thirty-five miles, tying the auxiliary steam plants and water power plants together by transmission lines so that the mills will be free, not only from the variation in the water supply but also from interruption of service due to breakdowns of machinery.

It may be objected that the opportunities for accomplishing this have most of them altogether disappeared. This, indeed, is regretfully true, but it is not altogether true and we have today many streams throughout New England undeveloped on account of their fancied inaccessibility, which can readily become available if the question of the possibility of the site of the mill near the water power be considered as unimportant and if transmission distances of from twenty-five to thirty-five miles be contemplated.

The development of water powers at high heads has not only advantages on account of the fact that the inefficiency of many small wheels is eliminated but also from the standpoint of the storage reservoir. Since with the high heads that are sometimes reasonably available the quantity of water necessary to develop a large power is so much reduced that reservoirs become important, which under low heads are of inconsiderable capacity. Along the Boston & Albany Railroad, between Becket and Chester, is to be seen an opportunity of carrying out such a plan as is here in mind. Whether the water in the Westfield river is sufficient for any development at that point is not here considered, but I assume that the water is in reasonable quantity

as it is used to operate several mills a little below. You will observe as you are traveling along the railroad that a canal of about five miles in length along the hillside would give at its lower end a head of approximately 400 feet and although there are no mill sites in the immediate neighborhood of such a possible power plant, there are good mill locations within ten miles down the valley.

When you examine the mills at Dalton, I invite you to look at one of the best reservoir sites in the New England States, probably rendered forever unavailable by reason of the presence of Crane's Pioneer and Berkshire mills at the bottom of what might have been a reservoir backing up the water beyond Weston's mill and turning this little branch of the Housatonic from a power stream of comparative insignificance into a stream giving a large continuous water power.

Down the Housatonic River at Glendale and two powers which have practically been abandoned — that at Glendale and the one at Challenders. The configuration of the ground is such that not only these two powers might be united, but if it were not for the present development of the river many feet additional head could be obtained in consolidating the heads by fluming the river for a distance of ten or fifteen miles.

The disadvantage of the location of mills along the rivers is most beautifully shown in our neighboring cities of North Adams and Adams, where we will find mill after mill with foundations sunk in the river beds at a very considerable expense and where once every five or ten years great repair bills on account of floods are encountered, though the configuration of the ground is such as would have permitted the consolidation of the water powers into one large, efficient central station plant.

The most notable example that has come to my attention of the wastefulness of low head development is to be found at Holyoke where the canals consume space which should be available for good factory sites and where they are losing from 20 per cent. to 25 per cent. of the entire power developed by reason of the inefficiency of many low head wheels in series. I claim that

it would not be correct to object that in such a case as that of Holyoke the inefficiency of electrical machinery and transmission would more than counterbalance the increased efficiency of the waterwheels, since we all know that the introduction of the electrical drive will of itself overcome the loss from belting amounting to more than the inefficiency of the electrical machinery and whatever increased efficiency there could be gained by the high head would be clear gain and increased power.

I do not intend in any of these instances to question the judgment of the builders of the mills or the developers of the water powers. The last generation certainly presented evidences of having at least as good a quality of brains as we have today; but I claim that simply because our forefathers worked out their problems as they did, makes no reason for our slavishly following their footsteps when the work that they and we have done in other lines produces new conditions which make it unnecessary in the future to meet their disadvantages. The changes the past twenty years have made in the design of water wheels and improvement of electrical machinery and steam engines renders today available the use of high water heads and long distance transmission and auxiliary steam plants, not only without a necessary decrease of efficiency but actually with an increase of efficiency and an improvement in the quality of the product.

What is here advocated then is the development by means of long flumes in large central power stations of as many rapidly flowing streams as are available; the development of streams that by reason of their distance from satisfactory factory sites have heretofore been considered unavailable; the increase in size of the power plants and the uniting under one management as many power plants as possible; as well as the operation under the same management of steam auxiliaries necessary for the delivery of constant power, the abandonment by the cotton manufacturers, as far as is consistent with present conditions of the generation of power as a part of their regular business and

the placing of this work in the hands of experts who will install the machinery, make the power and deliver it to the mill for the operation of their dynamos, the location of the mills themselves at points adapted entirely to their manufacture, taking into account both the accessibility to railroads and the comfort and convenience of their employees.

These questions are each separately worthy of your consideration and have formed the subject of many papers before your able society, so that I feel in order to have you clearly understand the case and the advantages of the solution that I propose, that it is hardly necessary to do more than to state the results which we hope to attain.

The present day marks an era of consolidation and specialization, and all that has been said is in direct line with this tendency and is hardly more than calling attention to the fact of the improvements in hydraulics and hydraulic machinery, electrical generation, transmission and application and the great change now made possible in the methods of power application over anything that has been seen heretofore in New England.

The advantage of these principles has been widely appreciated in the regions of the Rocky Mountains and beyond and by their application the manufacturers of these regions have succeeded in overcoming their very great disadvantage of inaccessibility and expensive fuel, even where they have had to run flumes and ditches from five to fifty miles in length and have had to transmit power to such great distances that the limit I have set of thirty-five miles seems to the western engineers so short that they do not hesitate at rendering available, powers that are at least 100 miles from a possible market.

The reception by you of the ideas here outlined I firmly believe will eliminate many of the present difficulties met in New England from the gradual increase in price of coal and will tend to solve also some of the questions that are so serious which present themselves with reference to the labor problem and will aid New England in retaining its cotton manufacturing business, which during the past generation has been so important in its development and prosperity.

The PRESIDENT. Gentlemen, Dr. PERRINE'S paper is open for discussion. I know there are several electrical experts in the room and evidently his paper has interested you deeply from the expression on your faces. Will some one of you kindly open the discussion? Personally, I do not profess to be familiar with the subject, otherwise, even if out of order, I would open the discussion.

Mr. JOSEPH MERRIAM. I would like to ask Dr. PERRINE if he considers it practical to take two or three branches of a stream and pipe them into one concentrated plant and what would be the expense of such work. The point I would like to draw out is whether a mill wishing to increase its power, possibly by two forks of a stream which it was not possible to attempt if the expense would not be greater than probably larger steam development.

Dr. F. A. C. PERRINE. I think that is a question of the size of the plant and as I said in the paper, if the cost of development does not exceed $300 per horse power I consider that water power, in reasonable size, is cheaper than steam if coal cost nothing and that, I think, answers the question, does it not?

The possibility of connecting several streams is a very easy matter and there is just one point I want to bring to the attention of men who are not electricians, and that is the coupling of modern electrical machinery together no matter how far apart they may be forms a positive union like coupling cog wheels together, so when you increase the number of your generators whether they are in the same plant or whether they are in distant plants is equivalent to increasing your fly wheel capacity. They have been coupled together distances of 80 miles and the fly wheel capacity of machines in these plants is thus added together.

A point I want to bring up which is of importance to cotton manufacturers is that many plants are tied together, even though the several plants may not be giving a steady power is of great importance.

In answering Mr. MERRIAM'S question I would say that in the first place I consider that if the cost of development is not in excess of $300 per horse power it is more economical to develop the water powers than to increase the auxiliary steam plant and secondly, that the development of water power in two or three points is not of any disadvantage as you get practically the same improvements due to more power that you would have if it were all in one spot.

Mr. ARTHUR H. LOWE. Mr. President, I would like to ask the Doctor to how small a unit he could apply that cost of horse power? ($300.)

Dr. F. A. C. PERRINE. That is a question of calculation, it is certainly true of thousand horse power units.

Mr. ARTHUR H. LOWE. Would that eradicate from the proposition all small powers?

Dr. F. A. C. PERRINE. Not if tied together.

Mr. ARTHUR H. LOWE. As an individual power?

Dr. F. A. C. PERRINE. As an individual power it takes out that particular argument.

Mr. ARTHUR H. LOWE. Does that mean that a power of smaller size would be of no practical value?

Mr. F. A. C. PERRINE. Not at all, I said that for the basis of argument; I will not stand up and justify anything smaller than 1,000 horse power but I do not mean by any means that it does not pay to develop a 75 horse power plant, but this particular argument is based on that.

Mr. FRANK P. SHELDON. I think the members may forget that all of Dr. PERRINE'S calculations of value of water-power are based upon a supposed use of the power for 24 hours per day or 7,512 hours per year. This does not interest cotton manufacturers who use power only ten hours per day or 3,070 hours per year. On this latter basis Dr. PERRINE'S method of esti-

mating would make the value of a horse-power about $122 instead of $300 or $81 per horse-power where he calls it $200. $81 is high enough.

Mr. EDWARD ATKINSON. Going back to reminiscences a great many years, to figures familiar to me 50 years ago when the Lewiston Water Power Company was being established, DAVID WHITMAN made a computation that a cotton manufacturer could afford to go to the extent of $3.00 a ton on his cotton and $3.00 a ton back on his goods to use a water power for which no charge should be made and that computation was based on what was then considered the low average of three pounds of coal per horse power per hour. That is a very extravagant average today where recent investigations of consumption of coal in 150 large establishments ranges from 1.1 pounds per horse power per hour up to 5 pounds but the average is very much below 2½ pounds so that I merely present this as an example of how things change in the course of time, whether they have any application or not.

DAVID WHITMAN'S demonstration did not prevent the construction of the Lewiston Water Power, it only demonstrated that four out of seven of the great water powers of New England or New York, at which some time or other I happened to be treasurer, were dead failures; the original million was sunk and the survivors had a fair profit as in the original investment at Holyoke was sunk.

This instance changes the whole aspect of the case as is instanced by the great works which I witnessed of the work at Moline, New York and North Adams the last year. A cousin of mine happened to be the founder of Moline and at the time he said it ought to be called Moulin, the French for mill river; they changed it to Moline. There the lumber interests and the manufacturers have combined, throwing up all the individual powers and establishing one great central electrical centre and are distributing power for fixed charges as Dr. PERRINE stated before.

Mr. CHARLES T. MAIN. I have been very much interested in the paper of Dr. PERRINE and there are two or three points on which I would like to say a few words. The value of water power and the amount which can be expended in the development of the same depends very largely on the use to which it is to be put. If it is to be used for electric lighting or railway purposes, say for 24 hours a day under variable load, more money can be spent on development than can be spent if it were to be used for cotton mill purposes, running say six days a week and ten hours a day on a fairly steady load.

The statement which the Doctor has made that $300 could be spent on the development, I think would hold good if the power is to be used for electric lighting or railway purposes on variable load and possibly $200 per horse power for use in cotton mills if the power did not have to be supplemented by steam. The cost of $100 per horse power, which he has stated as the limit which one could afford to expend on a variable power, is a general statement which I think is fairly well accepted and the reason for that is that the only saving practically in a mill which can be made by a variable water power is saving in coal.

If only about $10 a year can be saved per horse power by reason of having water power the manufacturer would be willing to invest in any development a sum that could return him, say, ten per cent. on the investment and if he could save $10 a year he would be willing to expend a $100 for the purpose of saving that $10.

The size of the development depends upon the cost of development and the cost of steam power and the saving which can be made by the use of water power.

I have found in the examination of a great many plants that a power is developed to use all of the water flowing in a river for six or seven months of the average year and for five or six months water would be going to waste. If the cost of the water power development is small one could afford to develop the water to use water for eight or nine months in the year and

waste water for only two or three months. If the cost of steam power is extraordinarily high the water power development could be carried to a greater extent than if the cost of the steam power were low. In colored mills where a large amount of steam must be used for other purposes the cost of steam power is reduced to a very small amount and in those mills the water power cuts a very small figure. They need water for washing and other purposes but the value of water for power is not extremely high. For example, at the Washington mills at Lawrence, Mass., a woolen mill where they use large amounts of warm water and exhaust steam, we installed a 1,500 cross-compound engine. All of the overflow from the condensers from these engines goes into large tanks in the dye house and is used in the dyeing and washing. In that mill there is also a simple non-condensing engine running about 2,000 horse power, all of the steam from that engine goes into the dye-house and is used for dyeing and washing and all the heat is utilized again. The cost of steam power in that mill is a very small amount. Therefore, the value of water power in textile mills is less than in almost any other development in which power is used, particularly colored mills.

As to the abandonment of power by the various mills and establishing concentrated central stations it must be borne in mind that nearly all of the mills must maintain boiler plants at their particular location for the purposes of furnishing steam for manufacturing purposes and heating buildings. In a large mill, for which we are consulting engineers, there is not a single large engine on the place, the whole mill is driven by water power, but in that particular mill 12,000 tons of coal are burned every year for furnishing steam for dyeing and finishing and heating the buildings so that it would be impossible with a centralized plant to do away with all the cost of steam power, a portion of it must still be maintained. What the Doctor has said about combining the various smaller powers into one larger one using a high voltage having only one station is perfectly true if it could be carried out and worked at great saving of power to various mills.

Dr. F. A. C. PERRINE. The only thing that has been brought up that I wish to speak about is this question of 10-hour power. It is perfectly true that the argument in the paper is based on 24-hour power, also you should not neglect to consider the fact that the argument is based on the central power plant even though it is used by cotton mills would not serve to take the load off somebody, we will say just exactly as our plant in Pittsfield is insured by the New England Factory Mutual Insurance Companies so that the plant
and another question that has been brought up by Mr. MAIN; of course I have said in the paper that I believe the water power at a certain price is cheaper than steam if coal cost nothing. I do not say if steam cost nothing. I do not think that I am unwise enough to advocate the uses of water power without any respect whatever to the particular conditions in the plant. I wish to thank you, gentlemen, for the attention and consideration that you have given on the remarks I had to make.

The PRESIDENT. Any further discussion, gentlemen? If not, we will proceed to the next paper by Mr. EDGAR H. BERRY of New Brighton, N. Y., the subject, Storage Battery Locomotives for Mill Yards.

STORAGE BATTERY LOCOMOTIVES FOR MILL YARDS.

EDGAR H. BERRY, New Brighton, N. Y.

The statement that this is an age of specialization is one that is often heard, and it has attained a certain standing, as being the expression of a well-established fact. But even though we accept this as being true, it does not follow that it tells the whole truth, and in fact, taking another point of view, we may safely assert that our large modern enterprises could not exist at all were they not headed by men who possess a surprising breadth of knowledge, which they can bring to bear upon the many problems they are called upon to solve.

Were this not the case, I doubt whether I would now have the pleasure of addressing this audience, or, if perchance I had blundered in among you, I would be as much out of place as the proverbial bull in the china shop.

But today, the question of transportation is one that is of vital interest to the mill agent, and I feel that an apology for presenting a paper on this subject would be superfluous. I will therefore content myself with expressing my appreciation of the courtesy extended by this Association in inviting me to appear before it. My thanks are especially due to Mr. W. S. SOUTHWORTH, and to your Secretary, to whose good offices I am particularly indebted.

In common with other industrial establishments, many cotton mills must face the condition that they have not been laid out

at any one time as complete units, but that they have developed as opportunity offered, sometimes by adding a new wing, sometimes by connecting existing buildings, and sometimes by the addition of an entirely new structure.

In planning and locating these buildings, many, and often conflicting requirements have to be met. The question of facility in transportation cannot expect to take precedence over all others, and some of its claims may have to be ignored in order to obtain the highest possible efficiency of the plant as a whole.

The more complicated the plan of the mill yard becomes, and the further the buildings encroach on the free space available for tracks and sidings, the greater the importance of providing adequate means for handling the freight cars loaded with the raw material or the finished product. No lengthy argument is needed to show the desirability of having all necessary switching operations controlled entirely by the yard boss of the mill, and performed by his own men, and I will start with the premise that the switching locomotive should be the property of the mill unless the volume of the business handled is too small to warrant the investment.

Assuming, therefore, that such a locomotive is needed, what should be its characteristics in order that it may be best suited to the conditions under which it is to operate? We may answer briefly that it must be safe, and that the cost of transporting material with it must be less than the cost of handling in any other way. Let us set down the features which such a locomotive would have to possess if it were absolutely perfect, and let us then endeavor to approach our ideal as nearly as we may.

Of all the great forces of nature, the first which man learned to employ for his own advantage, and the one to which he has most accustomed himself, is, in all probability, fire. So intimately has it been connected with the comfort and progress of mankind, that it has been tacitly accepted as one of the necessities of life in spite of the difficulties which we encounter in controlling it, and the dangers to which we are exposed, if we allow it, even for a moment, to escape our restraint. But even

though we have learned to look upon this danger with a certain amount of indifference, our ideal machine, which has to be in close proximity to highly inflammable material, should certainly operate without giving off sparks, dropping hot cinders, or requiring the presence of a flame. I wish to lay particular emphasis on this question of the fire risk, as I believe it relates to an actual danger which is often belittled or even entirely ignored.

Another requirement that may be set on the score of safety is, that the locomotive must perform its work without endangering the life or limbs of those who may have to cross the tracks, either mill employees within the yard, or else the general public, in case the tracks run on or across a highway. This calls for a moderate speed of motion, and perfect control under all conditions.

Convenience and economy dictate that the locomotive be handled by one man of ordinary intelligence, without requiring him to possess the special technical training that is necessary in the case of a locomotive engineer. A machine meeting this requirement possesses the further advantage that a substitute can take charge of it in case of the absence of the regular operator.

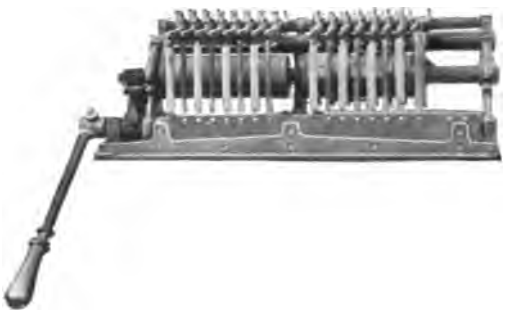
The mechanism should be simple, rugged in construction and easily accessible. The locomotive should be self-contained, that is, it should be capable of operating on any track of standard gage, either permanently or temporarily laid, without necessitating the previous erection of a trolley wire or other connection to a source of power. It should be available for service at any time, nights, Sundays, or holidays, and it should be available at a moment's notice without waiting to get up steam from a boiler full of cold water, or waiting to start up an engine and generator in a distant power house.

The first cost of the locomotive should be reasonable, and it should operate economically, even when it is only called upon for intermittent service This last condition means that there must be no consumption of power, and no coal burned to keep up steam, while the machine is standing idle.

FIGURE 1.

The accompanying illustrations show a locomotive in the design of which these ideal conditions have been set as the desirable standard of excellence. The decision as to how nearly this mark has been reached, I must leave to the unbiased judgment of the members of this Association. I will endeavor to present the facts upon which an intelligent opinion can be based.

The general appearance of the locomotive is shown in the side view Figure 1. There is no furnace or smoke stack, no trolley wheel to jump and spark, and no return current through the rails to flash over between the wheels and the track. The power is furnished by storage batteries, which are located in the sloping compartments at either end. Through the open door, we can catch a glimpse of one of the two motors. Above this, is the electrical indicating instrument, which shows the amount of power being used by the locomotive, and also indicates the state of the charge of the battery. To the left of this, but hidden by the door jamb, are the two operating levers. One of these levers is set in the direction in which it is desired to move, and the second one controls the speed. As far as the operator is concerned, these levers constitute the entire controlling mechanism.



CONTROLLER. — FIGURE 2.

The controller which these levers operate is shown in Fig. 2. It varies the speed of the locomotive by changing the motor connections, and not by inserting resistances, the heating of which would be wasteful of power. It is so constructed that the motors can only be reversed when the speed lever is in the

FIGURE 3.

off position, thus preventing a careless operator from burning out the motors or stripping the gear teeth by reversing while at full speed.

The speed reduction gearing between each motor and the wheel axle is enclosed in an oil tight case. This is filled with oil, and the gears run in a bath of oil, from which all dirt and dust are perfectly excluded. There are two motors, each with its own reduction gearing, and in an emergency one motor can be entirely cut out, and the locomotive operated at a diminished speed by the remaining motor. The motors and gearing are located in the cab, where they can be conveniently inspected at any time, and they are so proportioned that they will safely stand any load that the locomotive can pull on a sanded rail without slipping the wheels.

The photograph reproduced in Figure 3, was taken with good intentions, but unfortunately the locomotive is less in evidence than the freight cars. I include it, however, as it shows the load usually hauled. Experience has shown that three cars are most convenient although this load does not work the locomotive up to its full capacity. It has hauled with ease, fourteen small coal cars, each loaded with five tons of coal, and on a level track, it could haul in the neighborhood of 200 tons.

Figure 4 shows the equipment, probably familiar to most of you, which the locomotive replaced. Three horses, a driver and a tag holder, starting with a single car some distance up the

FIGURE 4.

track, and coming down at their best speed, were usually successful in making a flying switch, and throwing the car into the warehouse. If they failed, they either made another attempt, or else a gang of men from the warehouse, helped matters along as shown in Figure 5. I may add that the money formerly

FIGURE 5.

spent in shoeing the horses, comes within a very few dollars of covering the sum which should be written off for depreciation and maintenance expenses, and that the wages of the tag holder, who is no longer required, will leave a handsome profit after paying the interest charges, to say nothing of the elimination of the risk of his personal injury.

Now, a few words in regard to the storage battery itself. As its name would indicate, a storage battery is a device for storing energy, not for making it. A battery of a certain size and style has a definite capacity, which may be expressed by saying that when it is fully charged, it can safely be called upon to deliver a certain amount of power for a certain number of hours. Before it may be required to perform any further work, the necessary energy must be restored to it by a recharge.

I have just spoken of the "safe" capacity of the battery. Of course, you will understand that there is no hard and fast rule by which this can be fixed. In regard to this point, the user must trust to the knowledge and integrity of the manufacturer. In

a general way, however, I may say, that the factor of safety is very high in the best makes of battery.

Owing to the weight of the materials used in its construction, a storage battery is necessarily heavy. This has been a great stumbling block in the case of batteries intended for propelling street cars or automobiles, and the fact that batteries are used for automobiles in spite of their weight, speaks volumes for the desirable features they must possess in other respects. In a locomotive, on the other hand, weight is not a disadvantage. If the batteries were not heavy, the locomotive would have to be loaded with pig iron or equivalent material, in order to give the necessary adhesion to the rails, and there is therefore not the least objection to using a battery of the heaviest and most durable type, in other words, the battery which is usually employed only for stationary work.

BATTERY PLATES AND TANK. FIGURE 6.

In the locomotive I have just described, the batteries are of this type, and furthermore, their capacity is so chosen that they can safely deliver sufficient power to enable the locomotive to slip its wheels on a sanded rail. This is the maximum power that can ever be demanded of them, and the slipping of the wheels, therefore, provides a safety valve of admirable simplicity for the protection of the storage battery. Two sets of battery plates and one of the containing tanks are shown in Figure 6.

In the foregoing, I have confined myself to a locomotive suited for use on standard gage tracks. In Figure 7, I show a locomotive, designed on the same basic principles, but adapted

FIGURE 7.

for hauling lighter loads on narrow gage tracks. The capacity of this locomotive is about one-fourth of that of the larger one, the relative proportions of its parts remaining about the same. One feature of special interest, is the arrangement of the running gear, which permits the locomotive to run with great ease around the sharp curves usually found in industrial railways.

It has been my endeavor to present the salient points of my subject, without cumbering the description with a mass of detail. If I have abbreviated too much in regard to any point, I trust that you will not hesitate to call upon me for further information, which I will be glad to give if it is within my power.

The PRESIDENT. The subject Mr. BERRY has brought to our attention is, so far as I personally know, in the line of a new departure and with all that, one a good many of us have given some consideration to and thought of and I am personally inclined to believe there is going to be quite a future for his method. Will some of you be good enough to open the discussion or ask questions, I am sure Mr. BERRY will be glad to answer any questions. If there are no questions in connection with this paper

Mr. THOMAS HENRY SMITH. I would like to ask how long the batteries will last.

Mr. EDGAR H. BERRY. This is a question to which I cannot give a definite answer, in fact, I must say we do not know how long they will last because we have never worn them out. That does not mean they will last forever but it means that a locomotive I know of which has been in service for over four years is still in service and doing good work with the original battery plates. In stationary practice a depreciation of about ten per cent. a year is considered a fair figure. There is a little difference between the lasting qualities of the positive plates and of the negative plates of the batteries; the life of the positives is usually taken as three to five years and of the negative plates a little longer. You will understand, of course, that even if any of the plates should give out it would not necessarily mean the replacement of the battery as a whole; the plates of certain of the cells could be renewed.

Mr. EDWARD ATKINSON. Mr. President, I wish to say that the underwriters would like to promote the introduction of this mechanism in preference to some others there are efforts being made to work through the mill yards.

The PRESIDENT. Gentlemen, we are now about to be favored by Mr. EDWARD ATKINSON. It would be little short of impertinence in me to attempt any introduction of a man of such

dominant influence and usefulness and one so widely known. As most of you are aware, Mr. ATKINSON has interested himself in the work of this Association a number of years and when today he freely gives his valuable time to attend and address its meetings, you will, I am sure, all of you agree that the Association is fortunate and to be congratulated.

The Reminiscences of Mr. ATKINSON, unfortunately came to hand too late for the title to be inserted in the programme.

Mr. ATKINSON. Mr. Chairman and gentlemen. I had intended to spare you some of the dry part of the mud on which I am to speak on the subsequent evening, imposing a little light touch, leaving you to read and get out of the mud as best you could. The subject came up incidentally to my preparation to that paper and I scratched off a few Reminiscences thinking they might be entertaining.

REMINISCENSES.

EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

My connection with the cotton trade began sixty-one years ago when I entered the counting-room of JAMES READ, the founder of the Boston Manufacturers' Mutual Fire Insurance Company, of which I am now President.

One of my first duties was to copy bills and one day a bill came in for "mule saddles" and for something required by what was then called a "Jackass" loom. I wondered what such animals had to do in a cotton mill! On this beginning I gradually developed a faculty for asking questions and finding out what there was to be known about cotton.

If my memory does not fail me, changes in the number of yarn and construction of the cloth were then worked experimentally, the mathematical rule for draft and doubling not being then applied. I think they did not come into practice until DAVID WHITMAM was brought over from Rhode Island, to act as adviser or "Mill Doctor," as we called him, in the Lewiston, Biddeford and Salem factories. I recall him with the greatest esteem and respect. He taught me what little I know, but in some matters he could not teach me. I doubt if he knew himself why he pulled out the brass slide from his slide rule and put it back wrong-end foremost, bringing certain notches to bear from which he made computations.

In the decade preceding the beginning of my studies in the cotton manufacture, the average product of one operative in a standard sheeting mill, working thirteen hours a day, was less

than five thousand (5,000) yards per year. In the next decade it increased to about ten thousand (10,000) yards. In 1860 it was twenty-two thousand (22,000) yards with little or no increase during the subsequent period of war and reconstruction. It has now reached nearly forty thousand (40,000) yards in actual practice in ten hours' work a day, and even that may be exceeded.

I requested one of our experts to put a standard sheeting mill upon paper and to compute the lowest number of hands and the largest product as it might be under existing conditions. The return was fifty thousand (50,000) yards a year per operative.

Bear in mind that in the early period it was a step in advance for the farmers' daughters of New England to leave the isolation of farm life to go into the factory and to earn from one hundred and fifty ($150) to one hundred and seventy-five dollars ($175) a year in a low-studded, badly heated, badly lighted and ill ventilated factory where continuous physical exertion was required and high intelligence on the part of the spinners and weavers. There is said to have been deterioration in the quality of the operatives since that date but that is a mistake. The farmers' daughters of New England have been lifted into far better and more lucrative occupations while their places have been filled by men and women who would have been the merest of common laborers in former days, totally incapable of operating the machinery at that time. They now earn an average of more than three hundred dollars ($300) a year in ten hours or less per day, in a well lighted, well ventilated and thoroughly wholesome branch of industry, barring the monotony of some parts of the work.

Now you will observe that an increase of product from five thousand (5,000) to fifty thousand (50,000) yards a year stands for a reduction in the working force from ten operatives to one. Therefore, in a mill which now gives occupation to fifteen operatives per thousand spindles more or less, what will be the conditions ten years hence? We move faster now than we did

then. When the saw gin has given place to the roller gin, when combing has yet more and more displaced carding, and when improvements in top rolls lighten the weights, what will be your product per hand? Bearing in mind that a normal fibre of cotton as it comes from the boll is equal in tensile strength to a fibre of iron of the same size and section, how much do you impair it by the barbarous processes to which it is now subjected? There have been no actual measurements but I have reason to believe, that, after the cotton has gone through the mill, the bleachery and the print works, there is not over twenty-five per cent. of its initial strength remaining in the fabric. In proportion as you save this initial strength will you reduce the number of hands in the factory. I venture to believe that in ten years ten hands will do the work that now require fifteen. They will be in largest measure overseers, second-hands, section hands, yard hands and the like, probably exceeding in number the actual number of operatives who will be required to mend the ends and tend the machines. Each machine may have an electric annunciator to tell when it stops and it may be cheaper to let it stop a little while rather than to pay operatives who will be combing their hair or reading newspapers during the larger part of the time that they may remain in the mill.

During my connection with the Lewiston Mills, the Wellman & Woodman carding engine was perfected and the combination of the patents was brought about, I think mainly under the influence of DAVID WHITMAN. The factories with which he was connected bought rights for four thousand (4,000) cards which were introduced throughout the factories under his supervision. At the expiration of that patent I was chosen with the late Mr. BURKE, to defeat an effort made in Congress for an extension of the patent by the second of the patentees. Mr. BURKE prepared the brief and I did the work in Washington, succeeding in the effort and making the manufacture of that carding engine free to all without royalty which had lately been twenty dollars per card.

It was an interesting study but one of the saddest lessons was

the evil influence of sudden wealth gained in this way upon the families interested. Sometimes I think it is fortunate that so few inventors have the business capacity that may enable them to get the very large benefits which sometimes accrue on the few patents that possess any value, but this is not the time to deal with that abstract question.

In my experience I have witnessed one single great revolution in the work of the cotton factory. I cannot remember the exact date. After the death of DAVID WHITMAN, Mr. AMOS D. LOCKWOOD became the adviser of the same factories. He was sent to Europe to see wherein we might be lacking. I said to him just before he left, "I believe the British are twenty-five years ahead of us in sizing yarn. I do not know how it is done but I am satisfied that there is machinery in use for this purpose of which we have absolutely no knowledge and I hope you will give me early notice of what you discover." Shortly after his arrival he sent me a description of the slasher. I ordered one for the Continental Mills and one for the Indian Orchard Mills which shortly arrived. We had to take out the brick work between the windows in order to get the machines into either factory, there being no hatchway big enough. One man and a boy took the place of eight dresser tenders. The sizing room became one of the pleasantest, best ventilated and most wholesome rooms in the factory where the dressing room had previously been at a temperature of one hundred and ten to one hundred and twenty Fahrenheit, saturated with the smell of sour starch. I tried to follow the fate of the men discharged but they possessed aptitude and versatility. They found work and the change which presently extended throughout the cotton industry seemed to work itself out without any special hardship to those who had been previously employed as dresser tenders.

When one is nearer eighty than seventy he may lay aside all his native modesty and be a little egotistical.

After I had served my time as a boy in a store and had become established in connection with cotton manufacture, I determined to know all that might be known about cotton from

the field to the factory. I had left school with the ordinary memory of text-book teaching in what was called "geography". I had attained a little knowledge of geology, chiefly from attending Prof. LOUIS AGASSIZ' lectures, given, I think, in 1844, in which he gave the first development of the glacial theory and and its application to the northern part of this continent. I took very full abstracts of these lectures which I still have.

I had no knowledge of chemistry or of physical geography in any broad sense; hardly a conception of the relative areas of states and countries.

It is over thirty-two years since I became a member of this Association. I attended a meeting in rather a damp basement, lighted from the sidewalk, in the old Tremont Temple, and my first privilege was to secure the use of a hall in the Massachusetts Institute of Technology for subsequent meetings where they were held many times. Later I think you found it better to be near the business quarter, but now that the subway has brought the Institute close to the business section, it seems to me that it would be very judicious to go back there for the Boston meetings which may be made more interesting by the facility with which the lantern may be used and many demonstrations made that cannot be put into the Tremont Temple.

I cannot relate these subjects that I have brought to your attention in exact sequence by dates, but the second work was to bring before you the form and structure of the cotton fibre, giving the reason why it can be spun without any preparation except that of ginning. I did this with microphotographs, the first ever taken in this country and I think the first ever taken anywhere of cotton, wool, flax and silk. As I recall the fact, every member, except Governor STRAW, had the old idea that cotton was barbed like the beard of rye. My photographs were the first demonstration to nearly all the members of the true form and structure.

When I took hold of our end of a thread of cotton, working along the line, I found the other end in the hand of some Aryan woman in Central India, who, in pre-historic times, first picked

the loose cotton from the boll, twisted it in her fingers and doubling it with her teeth, made the first experiment in spinning cotton. Before I had untwisted that strand, seeking what might be found in its convolutions it had carried me into every branch of science and had brought light into the darkest problems of political and commercial history.

I found it necessary to study the areas and climates of continents, sections and states; the physical geograghy and geology of all cotton growing states; the chemistry of soils; the nutrition of the soil, the plant and the animal. Before I undertook to write my first pamphlet, Cheap Cotton by Free Labor, in 1861, I had such mastery of the conditions of cotton production as to enable me to prepare a statement which was prophetic in every part and yet my imagination fell far short of what has been accomplished in a single generation.

If one takes up any common article of commerce and manufactures, the same rule holds. The study of wool, of leather, of timber and of metals undertaken in the same way will lead any intelligent youth to such a study of the sciences which I have named as may make his trade the means of what may be called a "liberal education." If he posseses the factor of imagination, carefully guarded by induction from the facts that will be disclosed to him in the course of his study, he will then become capable of occupation in the higher places in every branch of industry where his merely technical instruction will qualify him only for the places of lesser importance.

Imagination is a prime and necessary factor in the conduct of all the large affairs of life, provided it is held in check and not permitted to generate into mere fancy or wild generalizations which are not based on adequate knowledge of the facts.

It may therefore be fit to lay out a course of instruction which may be taken up as a voluntary or elective course by the pupils in the textile schools who desire not only to comprehend the art of weaving or spinning or dyeing, but also to master what may be called the "philosophy of their trade."

I will now venture upon one more prophesy. I have many

times dealt with the subject of Sheep on the Cotton Field. Wool is as necessary or more necessary than cotton for clothing of people who live in cold climates and yet wool is mainly produced by what may be called "barbarous" or "semi-barbarous" methods.

The great flocks of Australia, the Argentine Republic and of our Northwest range over extensive plains where they are subject to drought and to all the hazards of heat and cold. It is said that a third or more of the sheep of Australia have been killed by drought in the last few years.

The flocks of our Northwest are known as "hoofed locusts," destroying the cattle ranches, eating out the grass by the roots on the hillsides and denuding the hills and mountains of young trees. In Europe on the other hand, especially in Great Britain, sheep are bred not only for wool and mutton but to prepare and renovate the soil for other crops. British agriculture is based upon sheep growing. Every country has its special breed, adapted to its particular soil and special climate. The Middle South offers opportunity for every variety of sheep except possibly the hairy sheep, from which carpet wools are derived, which come from the arid lands and calcareous sections, mainly of Asia and South America.

Every variety of long wool sheep can be bred in the high valleys and mountains of the Middle South while the Piedmont plateau or uplands extending from Virginia around the flanks of the Appalachain chain to Mississippi inclusive might be the very center of the fine wool growing of the world.

Soil, climate and conditions are all conducive to the production of breeds of sheep immune from the specific diseases to which the Northern breeds are subject when carried there. They may be fed on the partially exhausted cotton fields, on the refuse of the plant and on the huge variety of other food suitable for sheep, renovating the soil, doubling the cotton crop and adding the wool and mutton to the product. All that stands in the way is the ignorance and incapacity of masses of people, both black and white and the cur dogs which rule and ruin the state.

This is a passing phase. Under the influence of the Experiment Stations and under the leadership of intelligent men, both white and colored, farming is being rapidly improved; ere long, fence laws and dog laws will be enforced by public opinion so that the time is not far distant when sheep upon the cotton fields will be as necessary a part of the production of cotton as the artificial fertilizers now are.

In another generation I venture to predict that the Southern cotton states, of course including Texas, Oklahoma and other states west of the Mississippi with the Atlantic cotton states, will hold the paramount production and export of the wool of the world, coupled with the continued control of the production of cotton. All this is written in the facts that can be proved. All the natural conditions are waiting; the capital is ample, the only factors now lacking are intelligence and well directed industry.

These factors are sure to come and cheap wool from the cotton field will be put upon the market in less time than it took to produce cheap cotton by free labor.

I next, as I remember, brought before you the facts about cotton seed. In 1861, in my first pamphlet, Cheap Cotton by Free Labor, to which reference has already been made, I had laid out the whole future of the cotton seed oil industry. At that time there was but one little oil mill in the United States and its work was kept secret because the oil was treated for conversion into olive oil. In 1880, in the address which I gave in preparation for the first Atlanta Cotton Exposition, I also developed the future of the cotton seed oil industry, even at that time almost unknown. My Southern friends attribute to that address the subsequent immediate development of this great branch of industry, of which the value of the product last year exceeded $100,000,000.

The fourth subject was electricity. I had undertaken the work of mutual insurance in 1879, on my return from Europe where I had witnessed the first public installation of the electric arc light in the park at Antwerp. I witnessed its immense im-

portance and began to promote the introduction of electricity for lighting principally by the Brush Electric Light Company in our factories. But in the first year we had twenty-three fires in sixty-one installations, fortunately without any considerable loss. The naked wires were fastened one above another on the same beam or wall and the scrub women washing the floor of the mill set fire to it by cross arcs. I began to think we should have to throw it out. Neither the Brush Company nor myself had any comprehension of the danger or how to meet it. But I have always known where to go to find experts or men who could be developed into experts, and I went for your present Secretary, Mr. WOODBURY. He took up the subject and developed the causes of the hazard while our inspectors followed up the risk in a practical way. In the course of a year we learned how to meet the dangers. The rules were established for installing the plants. They have been extended to meet developments and invention but they have never been changed. They were rightly grounded on facts at the beginning and now the mutual underwriters probably have a larger proportion of electric hazard in their risks than any other underwriters in the world; yet by forecasting and providing against the danger we have yet to meet in my company a single loss exceeding five thousand dollars which could be traced to electricity, and only one loss of that amount; all the rest, few in number, very trifling. At this very time our electric experts are in conference with the electric manufacturers in order that we may meet the dangers of high voltage, a subject not yet fully comprehended.

I think the next subject, the fifth, which I brought before you was the constant of humidity, and its immense importance in spinning cotton. I induced you to call for an exhibit of the Garland atomizer. Since then the art has been developed.

The next, No. 6. After my return from England I called your attention to the English window fitted with mullion and transom which is still I think the best factory window, making more ample provision for light and ventilation than other forms.

I then began the seventh subject, the diffusion of light, since developed and now established as an applied science which no one questions.

I also brought over at that time the theory of rope driving, developed in the beginning by the Barbours in New Jersey, carried by them to their works in the North of Ireland, carried from there over to Lancashire and immediately adopted in the best mills where I found it and whence I brought over the theory of the subject and placed it before the Association. It was not very cordially received but has since been accepted and is now again being in part displaced by electric motors.

Number nine on the list was lubrication. We discovered at heavy cost the volatile quality of almost all the mineral oils then used for lubrication. Your predecessors each had, or thought he had, the best oil; fancy oils, mixed oils, mineral oils and the like. But I found that I knew little and that most of you knew less upon the whole subject. In the early records you will find a table of a hundred and fifty (150) mills of which there were over fifty (50) that ought to have been almost exactly alike on print cloth numbers. They varied two hundred and fifty (250) per cent. in the quantity, in the price and in the cost of oil by the unit of product and there was no connection between the variations. Again I called upon Mr. WOODBURY and Professor ORDWAY of the Institute of Technology. They went to work, developed the only machine in existence for ascertaining the co-efficient of friction, established the standard of safety in lubricating oils, and I then persuaded the Standard Oil Company by a little compulsion, to settle all their patent contests and to change their whole method of distillation. In a year they put upon the market an oil above our standard at a much reduced average price, saving to the members of our company a very large sum of money previously wasted in the price and quality of their lubricants. I see that this subject has come up again and I think it might be very useful to take my old table as a model and make another investigation on the same lines, each communication being a confidential one and no name being

disclosed, only the number by which each man may find his place when the results are published.

Again No. 10. On my return from another trip to England I called your attention to the totally inadequate methods of opening and picking cotton in this country as compared to those of Lancashire, where the opener and picker building is nearly as large as the spinning mill and where the utmost skill was then applied not only to sorting the bales of cotton, but sorting the cotton in each bale according to the kind of yarn in which it was to be put. I had found them twenty-five years ahead of us in carding. The roller card had been perfected and I remember in the address that I made at that time I told you that within ten years unless the card makers of this country mended their ways no first-class mill would work an American card. That prophecy was justified in less than ten years. I told you then that it was unfortunate that no GEORGE DRAPER had turned his attention to carding as he had to the development of spinning. It was in that trip of 1884 that I got the first hint on the diffusion of light.

On my return from that trip or one a little later I presented to you a treatise on English mills and also a very complete plan and lay-out for a textile school and laboratory, which I had prepared with the aid of the late Lord PLAYFAIR. I could get up no interest in the matter. I was twenty years too previous, as I have been on many subjects. You will not find any very great variation in the textile schools now existing, from the suggestions and lay-out in that pamphlet.

I have omitted in proper sequence over-head heating, one of the first suggestions I ever made, which was received with great distrust and a good deal of ridicule, but after a short time when it proved that two coils of steam pipe hung over-head could do the work of three against the wall, and near to the floor it took the place of the old system everywhere.

We also took up the subject of steam pipe coverings, then in utter confusion. We had found dangerous and combustible coverings, even straw wrapped about steam pipes in some large

establishments. The matter was thoroughly treated by Professor ORDWAY, later by Professor NORTON, and all the points in this art may now be considered subjects of applied science.

I introduced the deck roof of heavy plank, resting of solid timbers, since adopted in all the new construction that came within our influence and in many places on many factories, displacing the old dangerous pitched roof, hollow roof and Mansard roof. It originated with the late W. B. WHITING and I had put the second one on No. 2 Indian Orchard Mill.

The cyclone dust collector brought back by me from the flour mills of Minneapolis, was introduced in picker rooms, in the rag rooms of paper mills, in napping rooms and elsewhere, greatly to the health and comfort of the operatives and to the security of the mills.

I recall one suggestion in connection with our experiments in lubrication which has not been adopted. Mr. WOODBURY discovered in the ring spinning frame a certain law of vibration following a rhythm and curve of which you will find a description in the reports; the machine running without vibration at one point, then rising in a steady curve to the maximum, falling away again, indicating a rule of vibration in the whole machine, as I thought, not simply in the spindles or the ring rail. I therefore suggested that in the construction of the ring spinning frame blocks of hard wood should be introduced at proper points to prevent the vibration generated by the rapid motion of the spindles from being imparted to the metal frame or vice versa. Had I taken out a patent I should probably have failed to make anything out of it and possibly our friend DRAPER would have absorbed it. I still think there is an idea of value in this notion that may be applied not only to spinning frames but to other mechanism in order to do away with the vibration generated throughout a metallic machine by the rapid motion of only one part of it.

I also brought to your attention a compensation band of braided linen and cotton, the linen taken up when the cotton relaxes and vice versa. I have sometimes wondered why that band had not been adopted more widely.

I also brought before you the two hundred and forty-first worthless patent on a seamless top roll. I suppose there have been fifty or sixty in addition, but the leather cot and the glued seam still remain as ARKWRIGHT first put them on. Whoever invents a homogeneous, non-electric, seamless cover for your top rolls, as some one surely will, will have in his hand a great fortune and will add a large percentage to the product of every mill.

I have also omitted in its place the subject of mill lanterns. Early in my administration, I discovered that broken lanterns had been one of the most prolific causes of heavy loss. There was hardly a single lantern in use that was not unsafe. It took me two or three years before we could secure a suitable lantern. In the last ten or fifteen years there has scarcely been a lantern fire of any consequence.

It would be useless to name the other apparatus which has been standardized in the course of my professional work, all of which have been brought before you. Pumps, pipes, hydrants, hose, the spontaneous ignition of coal, the calorific value of different kinds of coal, the consumption of coal in border plants, the weathering of coal, etc.

The next subject on which I have pounded for many years, the roller gin and the improvement of baling cotton, is coming to fruition. The lap bale has come to stay. The roller gin is claimed to have been perfected. There have been several fortunes lost in this effort; there may be others, but in the end your cotton will not be mangled by the saw gin.

There is a hope that the impossible machine for picking cotton will come. The first hint of success I have lately found in the alleged invention of a pneumatic cotton picker drawing cotton from the boll through several pipes attached to one exhaust fan. In that may be the germ of a cotton picker and when that impossible machine is perfected the fibre may become the secondary product of the cotton plant, the seed being of prime value. I do not expect to live to see that day.

With a view to the future I may put in some suggestions in

regard to cotton that I have lately made for the visit of a very important commission of educators, numbering over thirty, who are about to visit this country to study our schools at the instance and cost of Mr. ALFRED MOSELY.

The British Cotton Supply Association is repeating the effort made during the Civil War to obtain cotton from other parts of the world. I have called the attention of these British visitors to the Red River valley separating Texas, Oklahoma and the Indian Territory; the two latter comprising seventy thousand (70,000) square miles, to which I have added seventy thousand (70,000) more on the Texas side, making the following statement of the potential of production which will apply to this one hundred and forty thousand (140,000) square miles, an area one-fifth greater than that of the United Kingdom of Great Britain and Ireland.

"It is as yet sparsely occupied, only a small part of the soil being yet under the plough. The crop of cotton in this section averages over 300 pounds per acre in a normal year, or 400 bales to a square mile. From 8,000 square miles of this 140,000, at 400 bales of 500 pounds each to the square mile, Great Britain can derive 3,200,000 bales of the strongest and best cotton fibre for all work up to the fine yarns for which Egyptian is required. Hybrids equal to Egyptian are now being produced in this section.

"The normal crop of wheat in this section is over sixteen bushels per acre, or over 10,000 bushels per square mile. Great Britain may need four bushels per head in addition to the domestic product, say 168,000,000 bushels, or 21,000,000 quarters. This quantity can be derived from 17,000 square miles adjacent to the river and its branches, to be carried to New Orleans in barges for transhipment.

"It therefore follows that by setting apart 25,000 square miles of this area for the supply of the United Kingdom, with all the cotton and all the wheat now required, there would remain 115,000 square miles for the supply of beef, pork and other provisions for export and for the ample support of the whole population needed for this work.

"It is not therefore fit, even necessary, that the British commission on schools should visit Oklahoma to study the making of an English-speaking State not yet fourteen years old, which is founded on the free, common, secular public school as the necessary basis of society"?

Further suggesting that they may turn the attention of the Cotton Supply Association from the futile effort to get suitable cotton from tropical countries in which the plant is perennial, to the Red River valley of our Southwest where the necessary frost kills the plant and makes way for the annual renewal without which the fibre deteriorates.

Regarding this commission which is about to visit us as one of the most important ever announced and believing that it will tend to unite the English-speaking people under the firmest bonds of interdependence, I have submitted these and many other suggestions to the gentlemen who are about to visit us.

With this I will conclude, having thus sketched out my function of leading you like the *ignis fatuus* over narrow ways amid pitfalls and bogs upon solid land. I know how often you have considered me a will-o-the-wisp and have hesitated to take up my suggestions. What will you do now? I brought you deep into the mud, asking you to share with me in the effort to bring light, heat and power from the depth of the bogs. You may think I resemble the man who was described as an exemplar of metaphysical science at a seaside place where I lately passed some time. The exponent of metaphysics was described as "a blind man who led you into a dark room to show you a black cat that wasn't there." Have I taken that part in leading you into the mud today? [Applause]

The SECRETARY. Mr. President, it is not very often that one has an opportunity in a paper before this Association to say that it has not fully covered the subject. Mr. ATKINSON has put before us in the most interesting manner about a dozen different points in his Reminiscences. After I received the manuscript of that paper I read it with a great deal of interest and turned to the card catalogue of the Transactions of the Association which contains about 18,000 cards, and found that Mr. EDWARD ATKINSON had taken the floor on 152 different subjects since he became a member of the Association, April 19, 1871, covering a most remarkable range of matters in any way appurtenant to the business. But reminiscences are contagious and as he has told you I was in touch with many of the matters alluded to, I can give another one in connection with the Jacquard loom. When the Lowell Textile School was opened I went there and gave a little address on the Purpose of Textile Education and two ladies went with me who were educators in the broadest term, being especially devoted to the developments of modern education, and they were very anxious to know in what way pedagogical principles could be applied to a matter of what they assumed was purely a mechanical affair upon which they knew nothing and had no appreciation of the scope of cotton manufacturing. They survived what I had to say and Mr. JAMES T. SMITH, the secretary, a most gallant gentlemen, took them after the exercises, while I was engaged elsewhere in attending to some details of the proposed plans of the school, into the Lowell Carpet Mills, and when on the train going-back to Boston I asked them if they enjoyed their visit in the mill, they said, "Yes and no, we were introduced to a very fine looking man, who looked very much like the pictures of Bismarck, he showed us round and finally we found him making fun of us." "I think not," I said, "I know whom you mean and there must have been a misunderstanding amid the noise of the machinery, as it is impossible that he should have treated you otherwise than most courteously." "Yes," they replied, "I asked him how they made those figures come into the carpets

on the loom and he said it was merely done by the application of a Jackass motion to the principles of the common loom." All this very much to the disturbance of the ladies who did not understand.

There are two or three little points as indicative as the wonder of the first electric fires. When the scrub woman was washing the floor and made a cross between a bare copper wire of an earth return circuit, and an iron column leading to ground, she said that the water blazed up and set the mill on fire, and went to the priest to learn if she had seen a miracle was advised that if she drunk less gin she would see fewer miracles.

As an example of the time in which Mr. ATKINSON first called attention to the importance of humidity at that time, a mill manager knowing that cotton spun differently in various weathers and had supposed that it was some function of temperature and in cold weather they made experiments without artificial heat and with varying temperatures reaching up, until I think some of the spinning and weaving was done at a temperature of 120 degrees, almost an insufferable one, and in a short time he found out the difference was one of humidity and not one of temperature and made investigations which have never come to the public as far as I know on that point.

Mr. ATKINSON was speaking about some of the results of the investigation of oil but he did not refer to the one of fire hazard and that was that the experience of his company for some 52 years showed that some 52 per cent. of the fires and 54 per cent. of losses were due to oils.

He alluded to the witholding of the names of the mills whose cost of lubrication was tabulated and published by him. A young man went into the office of a woolen mill in Woonsocket on his first business trip and said to the treasurer: "I have a very nice oil I would like to show you, it is second on Mr. ATKINSON'S list." The Treasurer said, "How do you do, I never saw you before, but I am glad to see you as I have been called on by a dozen whose oil was first on Mr. ATKINSON'S list, and I am very glad to see a man who has got down to number two,"

and the young man received a trial order for what proved to be a satisfactory article, and this led to further sales.

The overhead steam pipes was a renewal of invention which was very peculiar. The first heating by steam pipes used large overhead cast iron pipes five or six inches in diameter which did not suitably commingle the radiating heat with the air in the rooms which were very low and the heating was local especially on the heads of the people; in the meantime when Mr. ATKINSON took up the question anew wrought iron pipe had been introduced, and permitted the use of several smaller pipes and the stories of the mills were higher and so the development of both iron and cotton manufacturing had prepared favoring circumstances for overhead pipes under present conditions.

The suggestion of the insertion of wood in spinning frames to reduce the vibration was very successfully taken up by the late President, RICHARD GARSED, of this Association in his mills at Frankford, who had spinning frames on a stone floor in a one-story mill, which he was enabled to run at higher speeds with less men by the insertion of blocks of wood.

Mr. ATKINSON referred to the composite spinning band of linen and cotton fibres. I believe that the postponement of the further consideration of that suggestion was due to another matter of Mr. ATKINSON'S by which one suggestion overcame another. The difficulty of the composite spinning band was connected with a large hard knot inevitable with such a band.

About that time I called his attention to an English matter of joining bands which an overseer had just brought over from the old country, in which the band was twisted with a loop in each end, and the ends were joined together by a piece of wire in the form of a figure 3 hooked in each end, and then by closing it with a pair of plyers to the figure 8, the ends of the band were drawn together. The length of the band could be slightly changed by increasing or diminishing the twist to make it shorter or longer.

SECOND SESSION.

WEDNESDAY EVENING, SEPTEMBER 30, 1903.

The Association met in the Music Room of Hotel Aspinwall, Lenox, Mass., at 8.15 P. M., President WALMSLEY in the chair.

The PRESIDENT. The first paper this evening is by Mr. DANIEL MOORE BATES of Wilmington, Del., on Waxes in Warp Sizing.

WAXES IN WARP SIZING.

DANIEL MOORE BATES, Wilmington, Del.

Last Spring your attention was drawn to the reappearance of waxes in the sizing of warps. We had then just commenced at Rockford an investigation of a number of samples of satines of various counts and weights, in connection with trouble experienced in our dye-house in getting some of our colored work evenly dyed. As previously stated, we found in some cases "that the warps were coming up lighter in shade than the filling yarns, causing the satines to have a threadbare, starved look."

Below is a table of the results obtained. Each set of samples is from a different mill, and the figures given show the amount of waxy matter found in a half yard of the goods in the gray, after wetting out and steeping, and after full bleaching. Our chemist, Mr. LEONARD YERKES, extracted all the samples with ether, subjecting each to exactly the same treatment. A sample of raw cotton (Texas middling) was also tested in the same way. The figures therefore may fairly be compared, one with another.

Sample.	Description.	Gray. grams	After steeping. grams	After full bleaching. grams	Percentage wax from gray sample.
1	31-½" 64/124, 5.50 yd.	0.2037	0.2103	0.1098	0.49
2	39" 96/136, 3.75 "	0.3904	0.4496	0.2391	0.65
3	33-½" 96/150, 5.50 "	0.1907	0.2196	0.0905	0.46
4	39" 96/160, 4.10 "	0.4709	0.3076	0.1724	0.85
5	39" 96/160, 4.15 "	0.2978	0.1477	0.1333	0.54
6	40" 96/172, 4.25 "	0.3147	0.3607	0.1471	0.59
	Raw cotton (10.3 grams)	*0.0426			*0.41

The table shows that some samples contain little more waxy matter than is found from the ether extraction of raw cotton, while others contain over 50 per cent. more. At the same time, in all cases the bleaching removes only about one-half of this, indicating that waxes added to the warps in sizing are equally as difficult to remove as those found native in the cotton fibre. A curious result of the experiments is that in two-thirds of the cases, more waxy matter is obtained from the steeped sample than from the gray sample. Apparently this is due to the steeping so opening up the goods that the ether has a better chance to act and consequently extracts the waxes more thoroughly.

In the case of sample No. 2, the swatches were each pulled apart before extracting, and the warp and filling extracted separately. The following figures show the result.

ANALYSIS OF SAMPLE NO. 2.

	Gray. grams	After steeping. grams	After full bleaching. grams	Percentage wax from gray.
Warp,	0.2529	0.2779	0.1113	0.80
Filling,	0.1375	0.1717	0.1278	0.43
Total,	0.3904	0.4496	0.2391	

As seen, the waxes in the warp are almost double in amount those found in the filling, the latter being only slightly in excess of the percentage of waxes found in the raw cotton. This points very clearly to the use of waxes of some kind in sizing the warps of this lot of goods.

By a curious coincidence, the two samples showing most wax are from goods invoiced to us the longest time ago, while the two showing least wax are from lots invoiced us most recently of those tested. At the same time, the trouble which we expe-

* NOTE. Very prolonged extraction with ether gave 0.0590 grams, or 0.57 per cent. The Tennessee Experimental Station, quoted by C. P. BROOKS in "Cotton," gives "fat, 0.61 per cent." With any one of these figures as a basis for the waxes in raw cotton, the conclusions drawn are upheld. The figure in the table, 0.41 per cent., seems the fairest for comparison, as it was obtained by the same method of extraction as that used on the other samples.

rienced last winter in our dyeing has largely disappeared. This may be merely a coincidence, but it looks as if the matter of warp sizing as regards the use of waxes had already been taken in hand by the mills, so that we are even now feeling the benefit of their investigations. That the use of waxes in warp sizing was prevalent a few months ago among some mills seems undoubtedly true, for in addition to our own experience and investigation, we have heard from diffierent sources of similar experiences among New England bleacheries.

It is probable that no manufacturer of cotton goods who is in touch with the bleaching end of the business, would knowingly use waxes in his warp size, but the danger lies in the use of sizing compounds manufactured and marketed under fancy names, of the composition of which the user has no knowlege. If it is expedient to use a manufactured compound in size, surely there is little difficulty and expense in having a sample analyzed by a chemist, thus putting beyond all question the effect of such a compound on the bleaching and dyeing of the cloth.

In conclusion, let me add that we bring this matter before you, not in a spirit of complaint, but in one of co-operation. We know that the trouble has only to be mentioned to enlist the efforts of all to correct it, and to this end we rely on the assistance of the manufacturers of sizing compounds quite as much as on that of the manufacturers of cotton cloth.

The PRESIDENT. Gentlemen the question of sizing or dressing is one of very great importance in the weave room and if there are any practical weavers present an expression of their views would be valuable. Will some one kindly open the discussion.

Gentlemen, you will pardon me but it seems extremely unfortunate that there is so little discussion on these papers, which have been prepared after considerable effort on the part of the writers.

Mr. JOHN F. HAMLET. Mr. President, one paragraph in regard to the sizing manufacturers in this matter, I would say that I am conversant with size manufacturing which is so very largely carried on in New England and never was an ounce of wax put in of any form, and as far as I know of their sizes that I have analyzed I find the general result that there is no wax in the compounds and I have been familiar with some half dozen in New England. If the gentleman has trouble with paraffiin wax or other wax in his compounds I am sure they could not have been brought from the leading manufacturers of size compounds in New England.

Mr. DANIEL MOORE BATES. Mr. President, all I can say is in regard to New England responsibility in the matter, the six samples which were tested, as I recall, were all from New England mills. Now I spoke of a similar trouble to what we experienced, in other bleacheries, in New England. This information, some of it, came to me through manufacturers of sizing compounds. One told me that several years ago they had used wax in their size, that they had gone through bitter experiences and had discarded it once for all; but this particular manufacturer I think felt that probably some of his competitors were now going through the bitter experience they had suffered perhaps 10 years before. I think, however, probably the warning had been taken because, as I mentioned in the paper, we are experiencing very much less trouble from this than we did last winter.

Mr. JOHN F. HAMLET. I only referred to those I was personally familiar with, those I had known myself among the leading manufacturers and while that might have happened 10 years ago that was before my time.

Mr. DANIEL MOORE BATES. Evidently the mills controlled by the speaker are not those we are trying to get at.

The PRESIDENT. The next paper, gentlemen, is by Mr. JOHN GREGSON of Fiskdale, the subject, Bobbin Filling; Its Tendency to Kink.

BOBBIN FILLING; ITS TENDENCY TO KINK.

JOHN GREGSON, Fiskdale, Mass.

When filling was spun by the distaff and spindle, as was the custom a little over 100 years ago, our grandmothers, who turned the wheel and handled the distaff, knew just how much twist to give the yarn to make it strong and durable. When weaving left the hand-looms, and steam power looms took their place, a greater amount of yarn was required than could possibly be produced by the distaff and spindle. At this time JAMES HARGRAVES of Blackburn, England, invented the spinning jenny, from which 16 or more threads could be spun at one time. At the same time a humble barber, RICHARD ARKWRIGHT, in a town some 10 miles west of Blackburn, was busily engaged in developing the important series of inventions and adaptations, which resulted in the modern throstle spinning frame. ARKWRIGHT'S principal patents were secured in 1775, and in that year, SAMUEL CROMPTON of Bolton brought before the world his mule spinning frame, in which the drawing rollers of ARKWRIGHT were, with happy effect, applied to the spinning jenny of HARGRAVES. This machine has been improved and perfected, until as we see it today, each mule spins 1,200 or 1,500 threads at one time.

But in introducing machinery to take the place of one, who knew by intuition the amount of twist required for the yarn, we ran against another obstacle which has given us considerable trouble, and that was the tendency of the yarn from the filling mule to snarl or kink. I remember when a boy, the system

adopted at some mills; after the filling was spun, and doffed in large boxes, or baskets, they were placed in a dark room, on racks, three or four tiers high. The floor was laid with timbers some two inches apart. Below the floor, some 12 inches deep, was water running day and night. The filling was left in the room for some three days, when it was carried to the weave room to be used. The time that the filling had remained in this dark room, had so set the twist, that when the filling was used, each strand was perfectly straight, there being no tendency to kink or snarl. But in mills of 1000 looms or over, too much space was required for this ageing process, and something more rapid was demanded. At this time the process of steaming the filling, to enable the weaver to use the yarn in a few hours after being spun was adopted, and I think most all mills have adopted this system.

Some 30 years ago, some mills more progressive than others began to spin filling on a spinning frame. It was considered cheaper, and of better quality, than filling spun on a mule. There was not much trouble in the weave room with the filling produced, 5,000 or 6,000 revolutions of the spindle was all that was obtained, but when the Draper Co. had improved the system of spinning, and introduced the Sawyer, and afterwards the Rabbeth spindles, revolving some 11,000 or 12,000 revolutions a minute, then trouble began. Many and many a time I have seen bobbin filling carried to the weave room, that was a trifle heavier than the number called for, but containing the same number of turns of twist, as demanded by a finer thread. When the cloth was woven it was more like a Turkish towel, than a piece of print cloth or sheeting. Second quality cloth would rush up tremendously, indeed I have seen every piece woven thrown out for second quality. Various systems have been tried to overcome this difficulty. In some mills a hose pipe is used, and water allowed to run on the filling; others will take a watering can and sprinkle the filling; others will place the filling in boxes or baskets in the mill yard for a few hours, expecting the atmosphere to develop a filling that will not kink

or snarl. But none of these systems are absolutely perfect. Using water on the bobbins will ruin them; in a few weeks they have to be reamed out to fit the spindle, many being broken in the operation. Another trouble which is of vital importance on fine goods is the filling being wet on the outside layers alone which causes a greater contraction of the cloth, the cloth woven from the rest of the bobbin, two-thirds of the amount of the yarn being almost dry, will be wider on account of the filling coming from the bobbin easier. Considerable trouble is caused from this irregularity in the width of the cloth.

A system has been adopted and can be installed at a small outlay, whereby all this trouble can be avoided. There is no fear of the filling kinking, and it greatly improves the appearance of the cloth. You no doubt have heard some cloth-brokers say, they can tell by the feel of the cloth whether it has been woven with mule or bobbin filling; and there certainly is a difference, so that a man educated to the feel of the cloth, can tell at once the kind of filling used in making the piece of goods. I have known printers ask for a shipment of cloth and insist on mule filling being used in weaving it. These orders have been filled and cloth woven from bobbin filling has been shipped. After the bobbin filling has been through this process no man could tell the difference from cloth woven with cop or bobbin filling.

The system that has been adopted by some of our Northern mills is, to place the filling in a chamber, in bulk, or in large boxes containing the doffing from a number of frames; the bottom of this chamber is covered with slats, of say one inch wide, leaving one inch of space between them. Underneath this floor is a system of humidifiers, throwing out an atomized spray of water. On the top of the chamber is a pipe say 10 inches in diameter, connected with a fan which draws the moisture through the mass of bobbin filling. The moistened air is again forced in the chamber underneath, and again drawn through the filling. In some two or three hours the filling is ready for the loom, and it is next to impossible to have any

kink formed in the filling. The fibers of the yarn, which on bobbin filling are well laid, though having an extra amount of twist spun in the thread, after being through this process become fully as fibrous as mule filling, the cover of the cloth is just as soft and full, as if woven by cop filling.

In cloth that has to be used for cotton flannel, mule filling is invariably preferred, but if bobbin filling has been through this process the nap can be raised and the finish is just as good as cloth made from mule filling.

Some mills where the spinning room is on the upper story, will have a pipe extending from the spinning room to the weave room, or basement, where the chamber may be. The bobbins are thrown down the pipe which extends to the chamber in which the filling is being prepared, by which means the chamber is always full of yarn. The yarn taken out at the front of the chamber, causes the yarn in the pipe to fall lower, and again fill the box.

This chamber may be divided into sections, so that different numbers of filling can be conditioned.

In my experience I do not know of any other system by which the same amount of filling can be conditioned, or made weavable in so short a time.

The PRESIDENT. The subject, gentlemen, is open for discussion. It is a very tiresome detail that we all have to contend with in mill experience and work and it would be extremely interesting and valuable to hear the opinions of some of the members.

Mr. GEORGE OTIS DRAPER. Mr. President, I notice the reference in Mr. GREGSON'S paper to the serious damage of bobbins due to wetting the filling and I suppose that even with the kinking that Mr. GREGSON refers to if the yarn receives enough moisture to properly condition it, the bobbins must also receive more or less of it and be damaged accordingly. We, of course, in introducing the Northrop Loom which is used with

bobbin filling, ninety per cent. of the looms out have used bobbin filling, have run into this trouble in a great many places; the bobbins being steamed made have shrunk and the rings on the bobbins which are essential in holding the bobbin in the shuttle have loosened so that the bobbins had to be thrown away. Within a few months some of our customers have been using enamelled bobbins with our looms, there is nothing new of course in the use of an enamel bobbin but when our looms first went out the bobbin manufacturers in attempting to enamel our bobbins with the rings ran into difficulties and advised us it was practically impossible but recently they have discovered how to do this and the results are very interesting indeed; in fact, every place where they are using the enamel bobbins they like them very well and they are meeting every expectation.

Of course in saying this I am talking in a way for the bobbin manufacturers, it is apart from our trade.

Mr. JOHN GREGSON. Mr. President, I would say that the movement of the moistened air through the chamber being so rapid it seems to have no effect whatever on the wooden bobbins; it has an effect upon the thread, the fibre is raised, the moisture is there and yet not enough to spoil the bobbin.

The enamel bobbin which the speaker before me has made reference to simply will protect itself from the moisture but the matter of the fibre of the yarn being raised is not shown on the enamel bobbin. The system that I have spoken of I made particular mention to the fibre of the yarn being raised by the motion of the moistened air through the box, the bobbin is not at all damaged. I have used bobbins two or three years without any trouble whatever from the moisture placed in the box.

The PRESIDENT. If there is nothing further to be said, gentlemen, on this subject we will now call upon Mr. JOSEPH D. AIKEN, Taftville, Conn., for his paper on Gambling in Cotton.

GAMBLING IN COTTON.

JOSEPH D. AIKEN, Taftville, Conn.

During the past summer, while the upward tendency of the price of cotton was a subject of interesting discussion, we chanced to notice in an edition of one of our metropolitan daily newspaper a full page sensational and illustrated article devoted to the achievements of one of the men to whom was given great notoriety and applause for his being the master of the cotton situation at that time and seemingly the glory was so abundant as to embrace his entire family.

The article was so well presented that it might easily inspire the careless reader with the impression that the man glorified was really good and great, and had done a commendable service to his fellowmen, but, when freed from the hypnotic influence of the writer we were prompted to ask in all soberness, the plain question, of what good or benefit is a "corner" of a commodity to the community? and we have not as yet obtained a reply satisfactory to our understanding.

We have seen it stated that the recent flurry in cotton was merely a contest between the exchanges of New York and New Orleans for the vested right to chalk up or down the price of cotton for the world's contemplation, but, to the users of cotton this little friendly tussle is hardly as amusing as it is annoying.

That the present, to us, regrettable condition of the cotton market has been largely brought about by speculators in this particular branch seems evident, because of the little or no effect that the rising price of the raw material has had upon

the selling price of the finished product cloth and as evidence of this pure speculation, we may call to your attention, the fact that, there have been two "corners" in this year's cotton supply; the first syndicate carried the affair as long as they thought it to be prudent to do so, and then sold out to a second gang who immediately raised the price still higher and now hold, (in satisfied confidence) warehouse receipts for four-fifths of the spot cotton available.

As an illustration of the methods employed I will take the liberty of repeating an instance related to me.

A New York cotton broker who had made a great amount of money out of the market, organized a special bureau of his own on a large scale to obtain the best estimates of the cotton crop, at the same time he also organized another bureau to determine the probable consumption and demand by the spindles of the world, and acting upon the private information gathered from these two sources, the organization of which cost him one hundred thousand dollars, he became the possessor of millions.

The announcement has been made from an authoritative source that the profits of the New Orleans bull pool together with the bull-calves who followed the lead of the big fellows in this recent campaign, have amounted to about $10,500,000. Seven men of that city, who composed one of the gangs, cleared $1,000,000 each, and the camp followers picked up $3,500,000.

A telegram from New Orleans in one of the leading Northern papers at the time when one of these corners was cleared up claims that the ringleader and his associates received $7,000,000, of which $3,500,000 was on actual spot cotton which was bought at an average of nine cents per pound and that in the closing out of contracts an equal sum was made. Where did this money come from?

Is there no voice, no echo, to tell that story?*

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* FOOT NOTE. As an instance of the relative accuracy of the estimates of the cotton crop the *New York Commercial* of September 22nd contains the various estimates of the last cotton crop showing the relative worth of such advance computation.

It seems that but two brokers guessed the size of that crop correctly and

"Mr. Brady and Mr. Sorey
Are entitled to the glory."

To my mind this is an exhibition of courage and generalship worthy of a better cause, our assembly being an absolutely practical body of men, might for one moment revert to first principles and inquire whether this expenditure of energy has really created any wealth or either aided or added one iota to the productive force of field or factory?

We are informed that American cotton has been returning to New York for some months from foreign ports, chief amongst which are Liverpool, Havre, Genoa, Bremen and Barcelona, amounting in all to many thousands of bales and that as a result of the remittance of this cotton from Europe there has been an actual increase of stock on hand in New York.

Secretary WILSON of the agricultural department, in an interview on the twentieth of August declared that infinite mischief was being done to the cotton manufacturing interest and the cotton growing industry by the speculative movement in cotton; he states that in some instances manufacturers have found it more profitable to sell their cotton to the gamblers, and that cotton which has been delivered in Europe has been brought back to this country and used in the gambling operations, and our attention is held for a moment by the statement that, the

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The amount of the last cotton crop is determined as 10,758,326 bales.

"Following are the estimates last autumn made by 142 members of the New York Cotton Exchange: 10,400,000 bales, G. R. Dyer; 10,500,000 bales, P. Mallett, J. S. Bache, N. Norden, G. A. Milne; 10,550,000 bales, T. F. Russell; 10,600,000 bales, C. L. Cammann, S. Sinn, R. A. Springs, G. E. Adams; 10,644,000 bales, J. J. Chew; 10,700,000 bales, G. L. Schiffer, G. H. Rhodes; 10,725,000 bales, E. Y. Cohen, M. P. Levy; 10,750,000 bales, P. Hotze, A. Violett, W. D. Martin, O. Rosenheim, George Muir, D. O'Dell, L. Ellinger, L. St.Colby; 10,758,000 bales, W. F. Sorey, W. H. Brady; 10,800,000 bales, G. W. Neville, L. W. Valentine, A. G. Munn, L. M. Pearsall; 10,850,000 bales, F. E. Hill, L. L. Robbins, L. de Gumoens, J. F. Black; 10,875,000 bales, W. M. Cohen; 10,895,000 bales, B. F. Foulke; 10,900,000 bales, T. E. Hicks, C. L. Long, J. A. Klipp, C. W. Lee, G. F. Jones; 10,920,000 bales, A. K. Fernie; 10,950,000 bales, F. E. Story, R. Kohler, B. R. Smith, W. G. Carr, A. G. Black, E. Botassi; 10,950,000 bales, H. H. Johnson; 11,000,000 bales, W. W. Wendler, J. W. Wenman, W. M. Townsend, W. T. Maine, J. C. Latham, H. Schaefer, C. F. Schneiker, R. H. Rountree, Robert Moore, H. T. Munn, G. H. Miller, A. B. Gwathmey, E. W. Clark, Charles Stillman, J. O. Bloss, J. H. Garrison; 11,050,000 bales, W. W. Gordon; 11,077,000 bales,

cotton planter or producer has not profited by these high prices, as the commodity had passed practically from his hands.

In conclusion Mr. WILSON said that he saw no prospect of relief for the working people who are thrown out of employment by the closing of the mills, until the corner in cotton bursts and the price of the staple is reduced, and that although the new crop of cotton will soon begin to come in, the corner will continue as long as the gamblers can control sufficient money to absorb it. I have taken the liberty of quoting Secretary WILSON at this length that your attention may be fixed upon the expressed opinion of one of our Nation's present advisers and you will no doubt have observed that he has not hesitated to call the jugglers of the market simply gamblers.

To our mind nothing can be said that will justify the "squeeze" which has been in progress during the greater part of the current season, growing in intensity as the months have passed, there is, however, one plea of apparent plausibility which has been presented to palliate the act, and that is the defence, that, the bulls stand between the producer and the consumer, that the bears are always trying to break the market, and so deprive the

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William Ray; 11,100,000 bales, F. von Riper, F. B. Simpson, E. Leonard, O. Magnus, W. C. Hubbard, E. J. Scott, W. P. Quintell, C. D. Freeman, S. A. Fatman, E. K. Cone; 11,125,000 bales, R. J. Johnson, C. F. Laighton. 11,150,000 bales, W. H. Judson, H. Hagedorn, G. T. Dixon, C. Messick; 11,200,000 bales, W. Witherspoon, F. H. Wiggin, G. H. Wilson, A. N. Selter, H. H. Shearson, F. G. Speck, S. M. Lehman, G. Reitze, R. C. Allen, L. L. Fleming, T. J. Deegan, Henry Clews, W. M. van Leer; 11,225,000 bales, S. Ranger, E. E. Moore, H. Brennecke; 11,250,000 bales, John Tannor, A. Lehman, L. G. Schiffer, T. M. Robinson, H. H. Royce, W. T. Miller, H. W. Hannemann, B. S. Clark, R. P. McDougall, E. Dornemann, W. Tubbs, N. Herrmann; 11,277,000 bales, H. M. LeCount; 11,300,000 bales, H. C. Holder, J. F. Maury, D. H. Miller, William Mitchell, J. Temple Gwathmey, J. C. Royce, W. C. Johnson, J. E. G. Higgins; 11,375,000 bales, G. W. Cummings; 11,389,000 bales, S. M. Weld; 11,400,000 bales, E. M. Weld, S. T. Hubbard, William Mohr, G. J. Ranger, J. Riordan; 11,425,000 bales, G. de Gumoens; 11,435,000 bales, I. B. Froeligh; 11,500,000 bales, D. J. Sully, C. E. Rich, C. Mayhoff, H. A. Martin, S. Shield, P. Y. Fachiri, F. P. Guest; 11,525,000 bales, P. S. Gallatti; 11,600,000 bales, E. P. Walker; 11,700,000 bales, Rhd. Siedenburg, Jr., E. A. Fachiri; 11,760,000 bales, Rhd. Siedenburg; 11,750,000 bales, L. Mandelbaum; 11,800,000 bales, G. E. Moore."

planter of the actual worth of the commodity which he has spent his time and money in raising, and that, those who are engineering the "corner" are really saving to him his legitimate profit.

It is universally recognized as a noble and magnanamous act to assist or rescue some less fortunate being from threatening or positive disaster, but, if in the scheme to accomplish this, it is necessary to deprive or rob some other one of his property or life, it becomes rather difficult to assess the precise gain to humanity through the benevolent endeavor.

Upon a moment's reflection it will be seen that the thousands of producers of the crop could have gained nothing from the "corner," as the organized control, planned to accomplish this purpose, could not be put into action until the crop had come under its inflnence, and the independent planter eliminated from interference with the successful working out of its scheme.

Nor can these organizers be credited with the declared intention of raising the price of this article to stimulate an increase in the acreage of the coming crop, for this declaration was not made till long after the period of planting had past, and they are fully aware, that, before the growing crop is picked, that, both they and their high prices, like the Bedouins of the desert, will have silently folded their tents and as silently moved away.

The truth of the matter is, that these operators care little as to the size of the crop or whether the price of cotton is high or low, much preferring that it be fluctuating, for in the uncertainty lies the opportunity for gambling, and it may be noticed that every effort which they put forth is to augment this uncertainty, and to add to their knowledge any artificial causes, together with the natural ones of supply and demand, producing this effect.

Such speculation cannot assume a dangerous character without the indorsement and assistance of prominent business men and financial institutions, and it would seem that there should be a sufficiently high moral tone existing in business circles to frown down and prevent inordinate speculation of this variety.

The first instance that we can call to mind in history of anything approaching the nature of a "corner" in field products, is that narrative about 3,500 years old, of Pharaoh, King of Egypt, of whom it is written: "He gathered up corn as the sand of the sea, very much, until he left off counting, for it was without number, and when this was ended all countries came into Egypt, to Pharaoh, for to buy corn, that they might live and not die, and it was sold to all the people of the land."

If we read this record attentively we are led to believe that this "corner" was organized and engineered solely for the common-weal, whereas, the more recent one under discussion was invented and operated expressly for individual greed.

Whether "corners" have gained in worthiness as they have journeyed down the ages is up to your consideration and opinion when you are presented with the statement that there are two million spindles now idle in American cotton mills and twice as many more stopped in England and on the Continent through this pernicious transaction, and that amongst these operatives, deprived of the priviledge of working, may exist many occasions for economy and possible want.

Mr. HENRY G. KITTREDGE. The conditions of the cotton market for the last six or more months have been peculiarly favorable for speculation in anticipation of higher prices. Seldom has the trade been in a better position to take advantage of these conditions to corner the market and force prices upward. That there should be men sufficiently keen-sighted and daring to avail themselves of the opportunity to control and profit by the situation is not to be surprised at. It was not, strictly speaking, a gamble on their part so long as they could control capital sufficient to buy and regulate the distribution of the available supply of cotton suitable for delivery on a future contract in the New York Cotton Exchange. It was not gambling because it was not a matter of chance based on an unknown

contingency, or on anything not likely to occur. What was done was done on a well calculated certainty that there were those, spinners and others, who stood in need of cotton, very much more than could be found in the country. The so-called gamblers or speculators were simply more foresighted than their fellows and had all the money required to carry their schemes to a successful end. These are days of large dealings in trade and with commodities, with an abundance of capital to execute them, such as would have seemed chimerical ten or fifteen years ago. That such operations should be severely censured admits of no dispute with those who have a chaste standard of business ethics, but there are no legal or moral agencies by which they can be stopped so long as like methods are recognized and practiced in the so-styled legitimate lines of business. There were clear signs of a short cotton crop last November, notwithstanding the assertion of many to the contrary. The germ of speculation was then propagated and its development attracted the attention of the trade not many months after. Money backed up the views of the operators, who consummated their plans in May and the summer months before the advent of the new crop. How much the advance in price was due to speculative manipulation it is impossible to say, but the relation between the advance and the manipulation, was not so close as many were inclined to think. The prevailing sentiment in the goods trade, however, was that the rise in the price of the raw material was speculative and ephemeral, which operated against any corresponding rise in the price of the manufactured article. Corner or no corner, the shortage in the supply of cotton for the consumptive demand was, of itself, sufficient to enhance its price very materially, enough, it may be said, to curtail or stop manufacturing operations as effectually as happened to be the case under the speculators' regime. How much of a relief the current season's crop will give the manufacturer, it is difficult to prophesy, but from present appearances, considering the lateness of the harvesting period in connection with the unpropitious conditions affecting the growing plants

during the summer months, the relief will not be great. The time when killing frosts appear is the factor of chief moment now. It would not be surprising if this season outwitted last season for opportunities for corners, especially, if it should produce a crop of no more than 11,000,000 bales, when an American crop of 12,000,000 bales is needed. There is, apparently, no large stock of goods in the market, and if the general prosperity of the country continues this will be suddenly realized before long. Every yard of goods that may be manufactured will be wanted, but the serious question is at what price? Will the price at which goods can be sold allow the manufacturer to pay 11 to 12 cents a pound for his raw material, basis, middling grade? There was a time when he could pay this price and manufacture goods at a profit, but it was at a time when the American crop was 4,000,000 bales less than of late years. The trade has been accustomed to nine cents and under for middling cotton for the last thirteen years and it is no easy matter to raise it to a much higher level. It may resolve itself into this, that at eight or nine cents a cotton crop of 12,000,000 bales could be easily consumed at a profit, while at 11 to 12 cents, a crop of less than 10,000,000 bales would be enough. If manufacturing, here and abroad, should be good and the consumptive demand active, for the current season, a crop of less than 11,000,000 bales would be altogether insufficient and speculators' opportunities would be as great as they were last season.

The PRESIDENT. We will now proceed to the last paper of the evening by Mr. WILLIAM HAYES of Auburn, Maine, the subject being An Improvement in Cards.

AN IMPROVEMENT IN CARDS.

WILLIAM HAYES, Auburn, Maine.

I will only take a few minutes to present to you the "Batten and Hayes" patent, which is an additional top stripper to the revolving flat card. Mr. WILLIAM BATTEN is my carder at the present time. He grew up with the revolving flat card in England while I grew up with the old American double-carding system which many noted mills still retain.

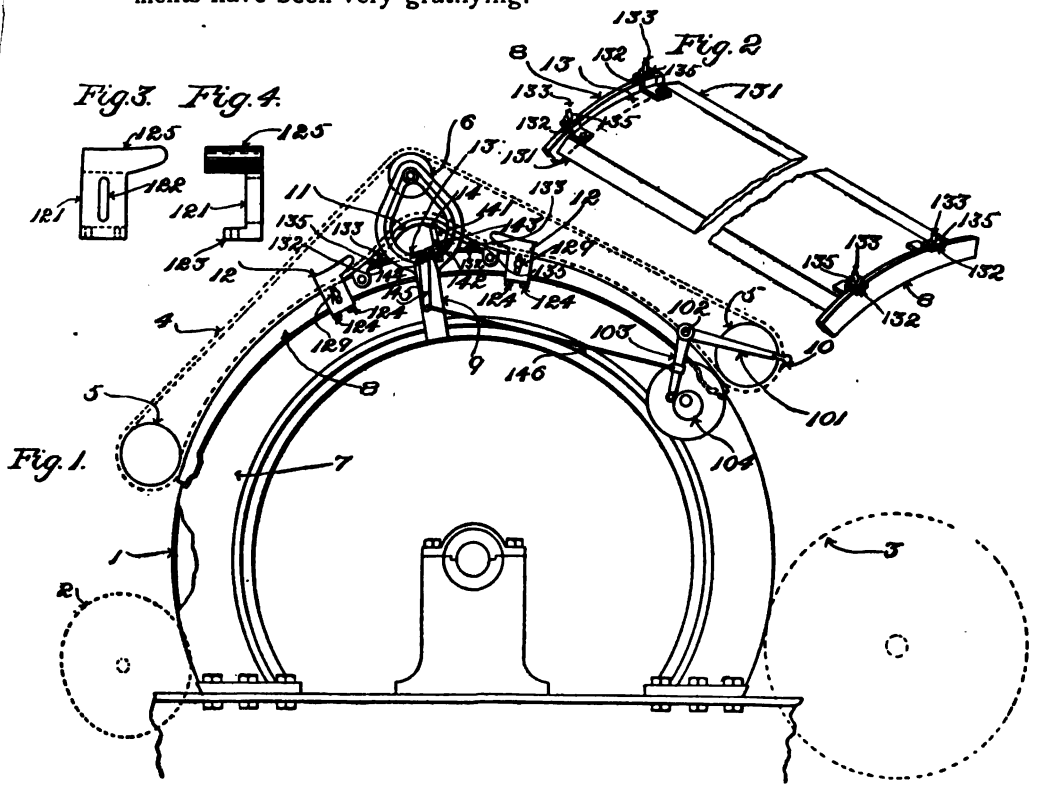
We were talking one day about the ins and outs of the two systems when he remarked that he thought the tops could be raised in some way and stripped as they proceeded in their regular traverse, so we joined our efforts and the result is the invention shown in the illustration.

You will notice samples of second drawing from 45 inches Pettee card carding 200 pounds in ten hours with the "Batten and Hayes" patent. The patent is new and has not as yet had extended and varied tests.

We use strict middling 1⅛ inches cotton at Barker Mill, Auburn, Maine, and we put 25 per cent. more work on to the card and still got less short fiber and the staple lay more parallel. We have made yarn number 28 twice from card in question and it tested five pounds above my regular yarn and regular process and the yarn looked smoother to us.

Our patent is simply an arch or bridge on top of cylinder over which the tops pass, and are stripped and then returned to the cylinder clean. These samples were made from card in

question and the tops were moving one third slower than usual. This additional stripper makes a low type of card stripping but the regular and second strippings are white and clean and contain considerable full staple and can, we think, go back into the work up to 35 or perhaps 40 yarn without being noticed or doing any harm. We have shown this sample sliver to several noted mill men from Maine to South Carolina and their comments have been very gratifying.



No. 11. Arch over which tops pass for stripping.
No. 13. Plate which covers cylinder under arch.
No. 132. Brackets which hold plate down.
No. 14. Stripping comb.
No. 9. Brackets which hold bearing of stripper rod.
No. 125. Brackets which hold tops as they approach and leave the bridge, same as No. 12 in position.
No. 146. Which connects combing motion.

This attachment was put in at mill without any outside help. Plate made in mill shop, tops covered by hand with rivets, so these samples of sliver shown at this time we have reason to believe are not so good as they will be when the attachment is put on by regular card builders.

The PRESIDENT. Any discussion, gentlemen? I take it that practical mill men are agreed that the carding engine is the backbone of the whole process of cotton manufacturing and any improvement in the cards should be gladly welcomed and encouraged. If there are any practical carders in the room the meeting will be glad to hear from them.

Mr. ARTHUR H. GULLIVER. Mr. President, I would like to ask Mr. HAYES what difference there is in the strippings which come off in this method and the usual strippings from the usual flat card. I do not quite understand; are they stripped with the brush?

Mr. WILLIAM HAYES. No, we simply borrow the motion and strip them, the tops come right up over the bridge.

Mr. ARTHUR H. GULLIVER. What do you take out of the top flat that you do not take out with the brush?

Mr. WILLIAM HAYES. I thought that question might be asked; our first strip we take out 5 ounces and the second stripping, as I said before, is very white and clean; 4½ ounces in an hour making 9½ ounces in an hour of the double strip while our regular strip which has not been changed over is 6¾ ounces, but I claim that the second stripping will go back and really make yarn of ordinary numbers, possibly up to 40 making net waste less.

Mr. ARTHUR GULLIVER. What do you mean by first strippings?

Mr. WILLIAM HAYES. Our additional stripper is on top of cylinder.

Mr. ARTHUR H. GULLIVER. The second stripping is taken out with a brush?

Mr. WILLIAM HAYES. No, the tops absolutely stripped in the centre and in the old way in front as they pass from cyilnder.

Mr. ARTHUR H. GULLIVER. What do you gain by that method of stripping?

Mr. WILLIAM HAYES. Less fine stuff in the fibre and laid much more parallel. These samples have been shown to twenty men and nineteen out of the twenty absolutely have said it was beyond any cotton carding known for the amount carded.

Mr. ARTHUR H. GULLIVER. Then do you claim, Mr. HAYES, that the present system of stripping is defective and puts back a dirty top on the cylinder?

Mr. WILLIAM HAYES. No, we keep the tops cleaner by additional stripper, it takes more fine stuff the first half of the carding. There where it joins the cylinder of course is already cleaned and then we take out the crown of the cylinder the dirty strip and the last half to a certain extent resembles combed work.

Mr. ARTHUR H. GULLIVER. Is the second strip left in the top after you strip the first time?

Mr. WILLIAM HAYES. There are two strippers; the tops pass over a little bridge and plate is put over cylinder to keep cotton from flying. We do just as good carding the last half as we do first, double carding on modern card.

The PRESIDENT. The session now stands adjourned until tomorrow evening at 8.15.

THIRD SESSION.

THURSDAY AFTERNOON, OCTOBER 1, 1903.

This afternoon was devoted to an excursion to the works of the Stanley Electric Manufacturing Company which is described in further detail in the Proceedings, page 90 of this volume.

FOURTH SESSION.

THURSDAY EVENING, OCTOBER 1, 1903.

The Association met in the Music Room of Hotel Aspinwall, Lenox, Mass., at 8.15 P. M., President WALMSLEY in the chair.

The PRESIDENT. Gentlemen, if you will please come to order we will at once proceed to the business of the last session of this convention.

The subject to be presented is one of intense interest and supreme importance, The Advantages of Steam Turbines for Textile Mills, illustrated by the stereopticon, Mr. AUSTIN R. DODGE, Schenectady, N. Y.

ADVANTAGES OF STEAM TURBINES FOR TEXTILE MILLS.

AUSTIN R. DODGE, Schenectady, N. Y.

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Within the past six years a great impetus has been given to steam engineering by the rapid development of the turbine as a substitute for reciprocating engines.

The advantages are many. To a casual observer of a turbine installation, perhaps the most apparent are the small amount of attention necessary, the small number of moving parts, compactness and simplicity.

All types consist of an opening or nozzle which may or may not be expanding, which receives the steam and directs it at the proper velocity against the revolving vanes. After the steam is discharged from the first set of vanes, the residual velocity may be utilized to reëvaporate some portion of the moisture inherent to the process of expansion, and enter a second nozzle. This condition insures expansion in straight lines, preventing eddies in the steam, but necessitates a high bucket velocity or a multiplicity of parts.

Another method is to direct the jet from the revolving vanes into a stationary set of vanes so arranged as to prevent material loss in velocity at the entrance, and redirect the jet at increased velocity by proper expansion into a second and third set of revolving vanes. This method permits a lower bucket velocity but the tendency for leakage of steam through the clearance spaces is somewhat greater, and the steam jet more irregular the farther it travels in a curved path from one direct guiding

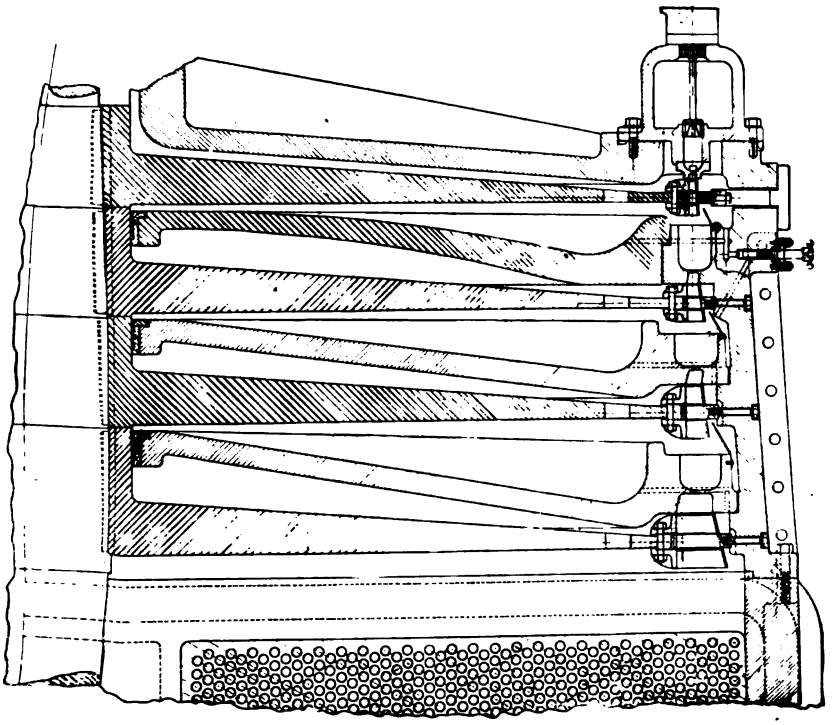

FIGURE 1. — ASSEMBLY OF 5,000 KW. FOUR-STAGE TURBINE.

nozzle before reaching another. The buckets revolving nearest the nozzle therefore show the highest efficiency.

A combination of nozzles with one or more rotating elements is called a stage. By increasing the number of stages, the velocity at the discharge end of each nozzle can be reduced, as the expansion is less, and a smaller number of wheels per nozzle is necessary to abstract the velocity, reducing the losses mentioned.

The efficiency of action depends largely on the relative velocities of the steam jet and the moving vanes, and the energy required to rotate these vanes under the existing conditions of steam density and moisture.

A comparison of the leading types now manufactured on the basis of these velocities will show the characteristic features of

each. The general details have already been fully illustrated in the technical press.

One of the earliest efficient turbines of practical form was brought out by De Laval, and consists of a single combination of nozzles and a wheel attached to the shaft, carrying the vanes on its periphery.

The transformation of pressure into velocity in the nozzle, is complex but highly efficient. The steam at the area of smallest cross section, called the throat, always has a pressure about 58 per cent. of the initial and a velocity of 1,500 feet per second, unless reduced by a higher back pressure at the discharge end of the nozzle. If a greater velocity is desired, the cross section at the throat is not changed, but the area of nozzle discharge is increased. We have, therefore, a means of obtaining any desired velocity entering the vanes by throttling the nozzle end pressure, if less than 1,500 feet is desired, and by nozzle expansion if a greater velocity is essential.

As the specific volume of steam expanding adiabatically increases in greater proportion than the cross section of the nozzle, the velocity increases rapidly. In the De Laval type, it is necessary to fully expand the steam before it enters the vanes, as any residual velocity leaving them is not available for work.

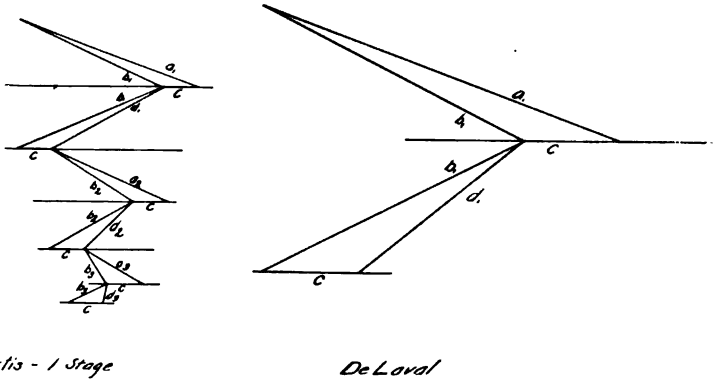

FIGURE 2.— VELOCITY DIAGRAMS.

A high velocity of the moving vanes is therefore essential. The accompanying velocity diagram will illustrate this.

A_1 is the direction and velocity of the steam issuing from the nozzle; C, the direction and velocity of the vanes; B_1 the resultant of A_1 and C; D_1 the direction and velocity of the steam discharged from the vanes. The conditions of maximum economy exist when the direction of the discharging jet is parallel to the shaft.

Actual tests prove this law even when the velocity generated in a nozzle is not brought parallel to the shaft until it is discharged from four rows of buckets.

As the angles of entrance and discharge are the same, the component of B_1 perpendicular to the direction of rotation, is balanced by the similar component of the discharging jet and as the wheel rotates in a medium which has everywhere the same pressure, there is no troublesome end thrust as in some types and a minimum of friction due to water of condensation, as there is considerable space between the wheel and the surrounding shell.

An initial pressure of 150 pounds will give a jet velocity of about 4,000 feet per second, if expanded to 28 inches vacuum. The vanes must therefore rotate at a speed of about 2,000 feet per second to abstract the maxium energy, a speed limited by the strength of material. About 1,200 feet per second is realized in practice necessitating the use of a flexible shaft and special gearing. This type is best adapted for a small range between initial and final pressures.

The Parsons machine was brought out shortly before the De Laval and has much lower velocities of steam and vanes, and the process of transforming pressure into work must be repeated many times, entailing a large number of successive revolving rows of vanes with stationary rows of vanes between each. As there is considerable drop in steam pressure between the entering and discharging sides of the revolving vanes, owing to small clearances, an unbalanced pressure acts on the vanes, resulting in a serious end thrust which is reduced by making

the drum carrying the vanes of small diameter, thereby increasing the revolutions per minute and the difficulties of generator design, as gearing is not used.

Many of the vanes must therefore rotate in steam of high density and there is considerable brake action between vanes and outer shell due to water of condensation. Both of these losses are reduced by superheat. The large number of vanes, about 31,000 in a 300 kilowatt set, are inserted by hand and the longer ones held at the outer end by supporting wires to which the vanes are soldered.

The Rateau type is similar to the De Laval, except that the combination of nozzles and single wheel is repeated several times, with less expansion during each process than in the earlier turbines. A space is given for the steam discharged from the revolving vanes to utilize its energy in the form of velocity by evaporating part of the moisture, and start the process of fractional abstraction anew in the following nozzle. A single wheel per nozzle, or group of nozzles affords a minimum change in the direction of the steam jet at high velocity and lessens its opportunity to diverge, before a following nozzle again brings it into line.

The outer clearance is small and the buckets have no outer band like the De Laval; but as steam is admitted only in sections of the periphery, end thrust is eliminated as the pressure on each side of the disk tends to equalize through the empty vanes.

The cylindrical clearance space between each intermediate nozzle and revolving element is near the shaft where the clearance can be made a minimum. This increases the area of stationary nozzle surface near the revolving elements and adds to the loss through friction. As in the Parsons type, many of the wheels revolve in steam of high density and the friction caused by water of condensation is considerable. A print of this turbine recently published shows twenty-five wheels and twenty-five sets of directing nozzles. Proper adjustment of these twenty-five clearances with variable shaft temperatures, leaves much to be desired as to simplicity.

Still another type is that brought out in this country by Mr. CHARLES G. CURTIS, which in addition to nozzles delivering steam at high velocity to a single wheel has also stationary vanes or intermediates which redirect the steam discharged at considerable velocity from the first wheel, due to the relatively low bucket

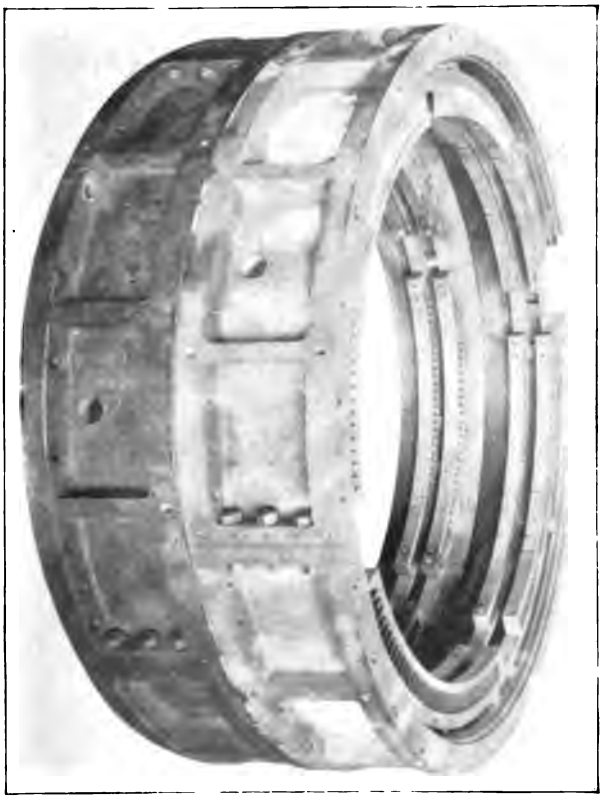

FIGURE 3. — TWO INTERMEDIATES FOR SECOND STAGE OF A 500 KW. TURBINE.

speed, into the second wheel. The velocity of the jet leaving the nozzle is about 2,000 feet per second, about half the velocity of the De Laval under the same conditions of exhaust pressure, while the peripheral speed of the vanes in the Curtis is propor-

tionally much less, about 400 feet per second instead of 1,200 feet per second. By this process of fractional abstraction the speed of revolving vanes need not be excessive to secure maximum economy, in other words to bring the direction of the jet discharged from the last set of vanes parallel to the shaft, as shown in the velocity diagram. With this high steam velocity only a minimum of revolving vanes are necessary, and they rotate in steam which has a lower density, due to the consider-

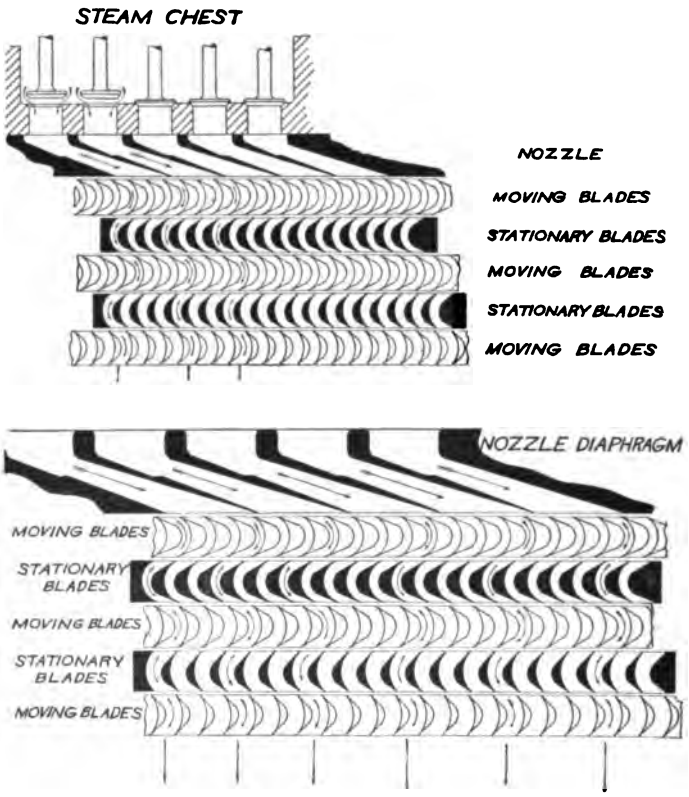

FIGURE 4. — DIAGRAM OF NOZZLES AND BUCKETS IN CURTIS STEAM TURBINE.

able drop in pressure from one stage to the next. There is a large clearance between outer wall of revolving vanes and the shell, reducing friction due to water of condensation. End thrust is eliminated, as there is abundant opportunity for the pressure to equalize on each side of the revolving disks, and the entrance and discharge angles of the vanes are the same.

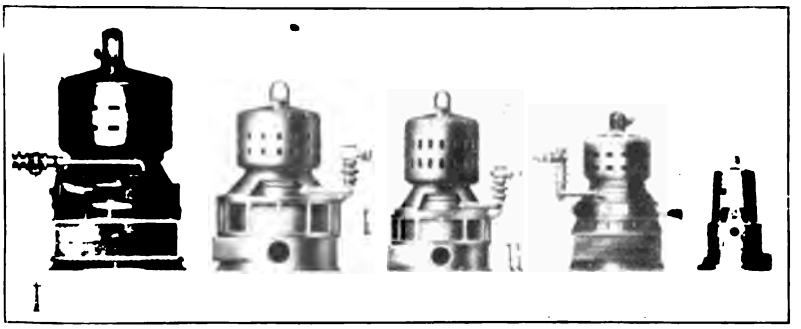

FIGURE 5.—COMPARATIVE SIZE OF VERTICAL TURBINES, 5,000 KW., 3,000 KW., 2,000 KW., 1,500 KW., 500 KW.

The Curtis type differs from those already described in a number of ways. In the larger sizes the shaft is vertical and floats on oil under sufficient pressure to balance the weight of the revolving element, which rises a few thousandths of an inch until the clearance is sufficient to permit the discharge of the oil delivered at the center of the supporting block.

That there is no end thrust in this turbine is shown by the fact that the oil pressure necessary to float the revolving element does not change under any condition of load. This vertical arrangememt affords great compactness and greater uniformity of expansion due to heat.

The clearances between stationary and moving parts have proven thoroughly commercial, as shown by several months operation of vertical 500 kilowatt units. In cases in which the oil pressure has failed while using a temporary belt driven oil pump, there has been no damage to the revolving or stationary vanes. Any contact which may occur is due to the lifting of the revolving ele-

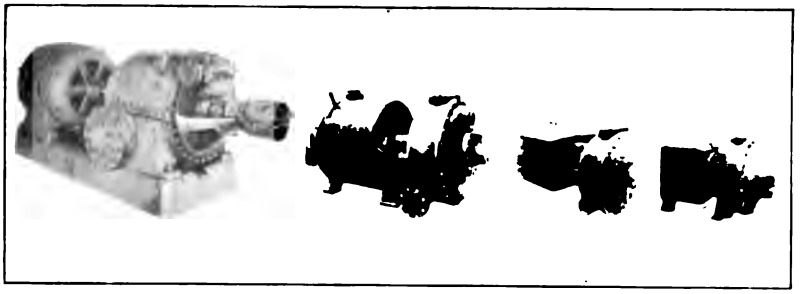

FIGURE 6.— COMPARATIVE SIZE OF HORIZONTAL TURBINES, 100 KW. 25 KW., 15 KW., 1¼ KW.

ment owing to formation of ridges on the step bearing surface. The weight of the revolving element therefore tends to nutralize any tendency to injury. As the vanes are less in width than the metal from which they are cut, nothing more serious happens than a polishing of the solid part of the wheels. Even the step bearing blocks can be faced off and used again. With the standard type of oil pump, direct connected to a motor by gearing, such a failure of the oil pressure is highly improbable. The use of a weighted accumulator eleminates the possibility of trouble and has been adopted in several plants.

The 500 kilowatt unit has two sets of nozzles, each delivering steam to a set of three revolving disks, carrying the vanes, which are machined from the solid disk. Governing is effected by operating a series of valves which control the admission of steam to the nozzles of the first stage. This insures a constant velocity in the first stage nozzles, while the pressure in the first stage diminishes with the steam flow, until at no load it is nearly equal to the vacuum in the second stage, a desirable condition, as the density of the steam in which the first stage wheels rotate is reduced, and adjustment of the valve controlling the second stage nozzles eliminated.

The following table embodying approximately the velocities of turbines of 300 kilowatts to 500 kilowatts capacity will aid in this comparison.

Type.	Rows of rotating bucket rings.	Steam velocity feet per second.	R. P. M.	Peripheral speed feet per second.	Buckets.
Parsons,	35	400	3,600	200	inserted
Rateau,	25	800	2,400	400	inserted
Curtis,	8	2,000	1,800	400	solid
DeLaval,	1	4,000	20,000	1,200	inserted

Each type has its characteristics and the advantages of one over another will depend largely on the cost of construction, reliability and improvement in efficiency.

The amount of capital invested in cotton manufacturing interests has been estimated at over two billion dollars. Let us consider the utility of the steam turbine in increasing the return from this investment. The desirability of the electric drive in textile mills has been clearly established and has already been brought to your attention by Mr. SIDNEY B. PAINE. The advent of the turbine, obviating the necessity of changing reciprocating motion to rotative motion will rapidly increase this application of electricity to your factories.

As to the first cost of such an installation, a Curtis turbine requires only 7 per cent. of the floor space taken by a horizontal cross compound engine of the same capacity, and the cost of foundations is in about the same proportion in favor of the turbine. The weight is from 15 per cent. to 25 per cent. that of the engine.

With a moderate amount of superheat there is no wear resulting from the action of the steam jet on the vanes, even at a velocity of 2,500 feet per second, as shown by long continued tests. The economy therefore remains constant, which is not true of a reciprocating engine.

One of the great advantages of a turbine is due to the entire absence of internal lubrication. Consequently the condensed steam can be returned to the boilers, saving the cost of oil and feed water, often 10 per cent. the cost of fuel. As no boiler scale is formed while using the same feed water continuously, tube cleaning is unnecessary and the boilers are maintained at the highest efficiency without withdrawal from service.

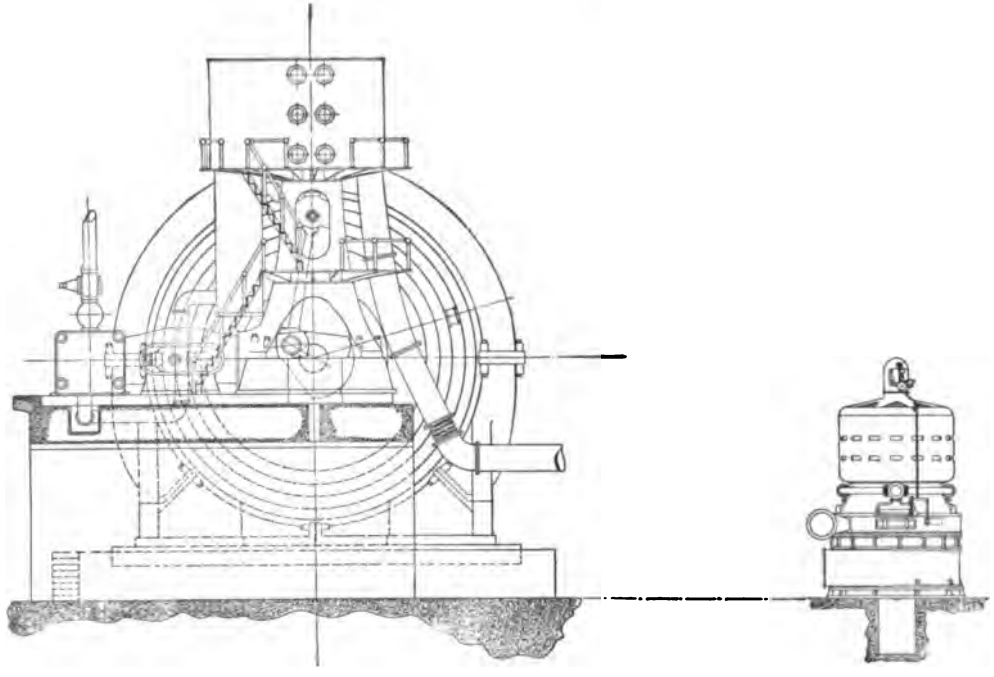

FIGURE 7. — COMPARATIVE SIZES OF 5,000 KW., 75 R.P.M. CORLISS ENGINE AND 5,000 K.W., 500 R.P.M. CURTIS TURBINE.

It is estimated that the saving in attendance charges will average 25 per cent. on the entire station pay roll. A turbine having but one moving part requires no adjustment, unlike a reciprocating engine with a large number of moving parts, which must be carefully inspected at frequent intervals by a skilled engineer.

One of the principal requirements of textile mills is uniform speed. A turbine has a large amount of stored energy in its revolving parts and is therefore well adapted for work requiring close regulation. Attached are two curves showing the regulation of a 20 horse power turbine and also a 50 kilowatt turbine, when full load is suddenly thrown on and as suddenly removed.

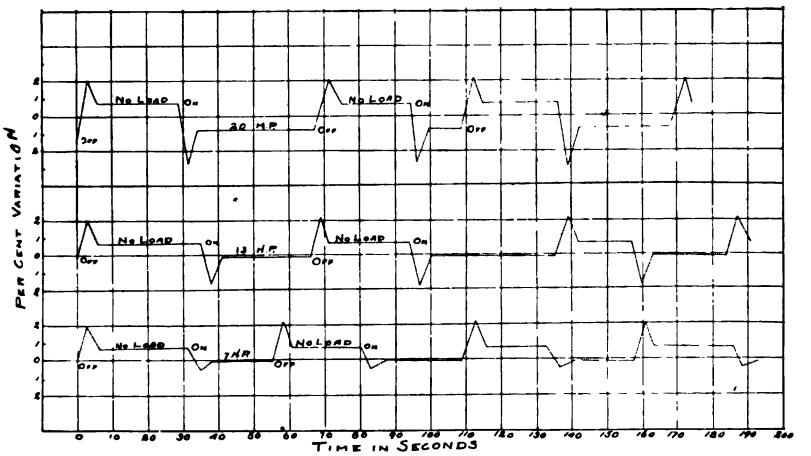

FIGURE 8. — CURVES SHOWING REGULATION OF 20 H.P. CURTIS TURBINE 3,000 R.P.M. WITH SUDDEN CHANGES OF LOAD.

The variation in speed of the larger units is within two per cent., when the load is varied from no load to full load. Fly-wheels are not required on any type, as the driving force is always transmitted without angular variation; a desirable condition when generators are operated in parallel.

The absence of internal lubrication permits a high degree of superheat. In the Newport plant the superheat of the turbine

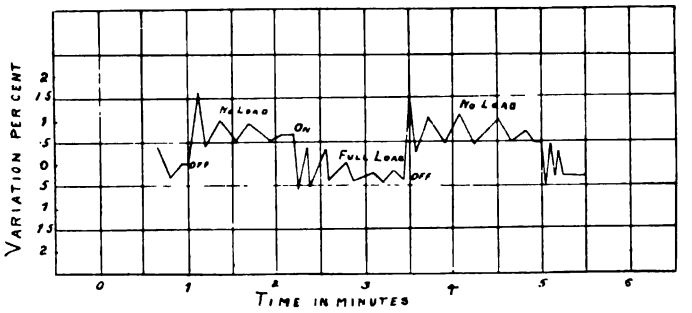

FIGURE 9. — CURVE SHOWING REGULATION OF 65 H.P. CURTIS TURBINE 1,800 R.P.M., WITH SUDDEN CHANGES OF LOAD.

has been raised to 250 degrees Fahrenheit without increasing the temperature of any part of the revolving wheels or surrounding casing, except the admission valves. The conditions in an engine operating at this high temperature would not be as favorable.

Actual experience in commercial operation has shown that water carried over from the boilers in large quantities does no injury to any part of the turbine, a serious condition when engines are in use.

The first vertical turbine engine to be installed in this country was at Newport, R. I., and has given the following results which have not heretofore been published. Comparison with a Corliss cross compound condensing engine of similar capacity under the same conditions of pressure and superheat is also made, assuming the engine to have the same full load economy. Few engines of this capacity, even when new, can show as high efficiency at full load. The curves clearly indicate the saving afforded in steam by installing a turbine, when operating at light loads and overloads.

The motors required to operate the circulating and air pumps for the condenser are driven from the turbine generator and this power, about 20 kilowatts, is included in the output of the machine. Analysis of the velocities obtained indicate that this result from the first vertical unit will be materially reduced.

FIGURE 10.— NEWPORT STATION, NEWPORT & FALL RIVER ST. R. R. CO. GENERAL VIEW FROM GALLERY, SHOWING SWITCHBOARD.

Lighting, railway and arc load are all carried on the same unit without difficulty. Minor troubles have developed but no more than with every radically new device, and these have in turn been corrected as rapidly as possible under commercial operation.

The station is arranged for four turbines two of which have been put in service.

Similar plants have been installed at Scranton, Pa., Dover, N. H., and within the past year orders have increased to such an extent that 200,000 horse power of Curtis turbines are under contract. A 600 kilowatt horizontal unit has been in continuous service at Schenectady for two years, operating for two periods of about four weeks each without a single shut down.

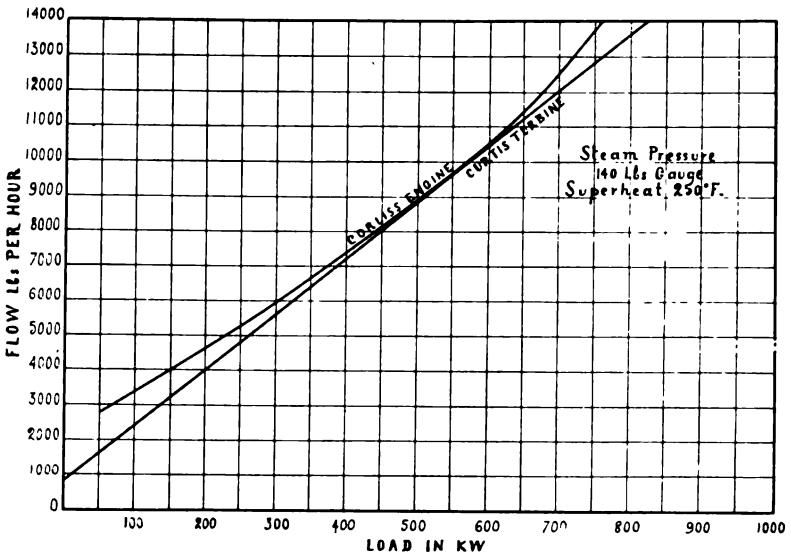

FIGURE 11. — CURVES OF STEAM FLOW AND OUTPUT 500 KW. UNITS ASSUMING SAME EFFICIENCY AT FULL LOAD.

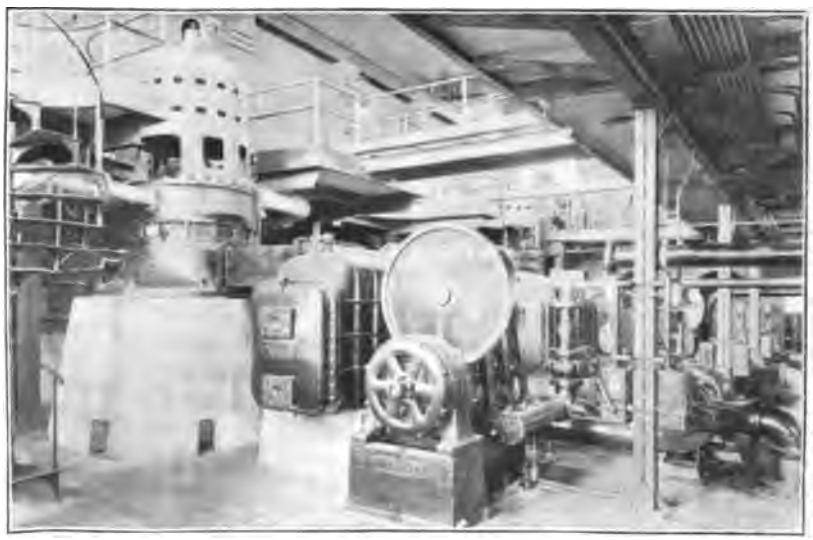

FIGURE 12. — NEWPORT STATION, NEWPORT & FALL RIVER ST. R. R. CO. GENERAL VIEW OF BASEMENT SHOWING A. T. B.–4–500–1,800 TURBINE, CONDENSER AND OIL PUMP.

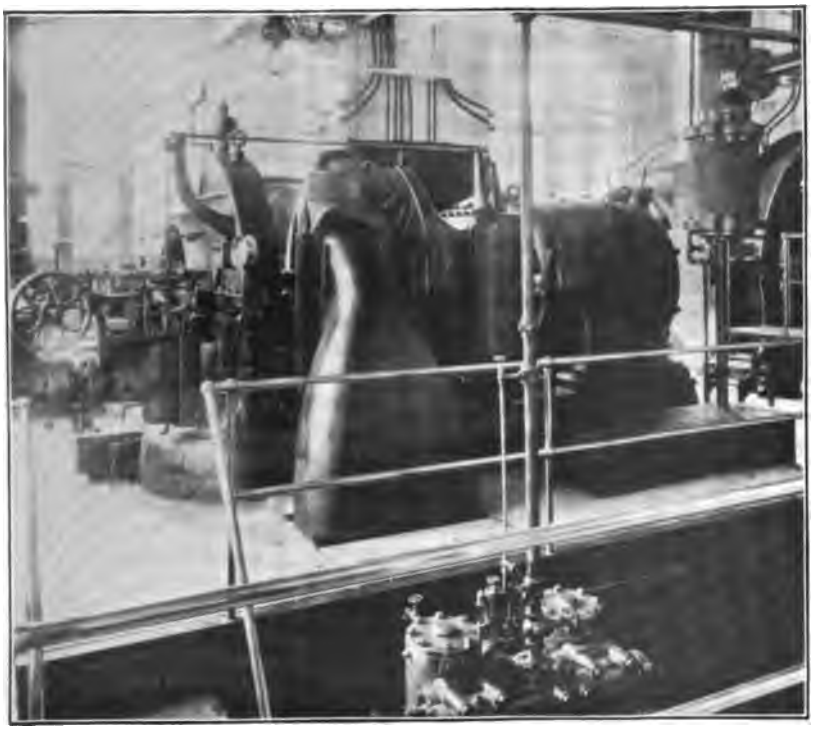

FIGURE 13.—500 KW. 1,200 R. P. M. CURTIS STEAM TURBINE SET, USED FOR POWER IN G. E. POWER HOUSE.

A 1,500 kilowatt Curtis unit is in successful operation at Port Huron, Mich., carrying a mixed load of motor power, railway and lighting. This turbine has the standard clearance of .03 to .05 inches between stationary and moving parts, and can be started cold and brought up to full speed in half an hour. It is easily brought into synchronism with other three phase generators driven by cross compound engines. One 800 horse power Russell and one 500 horse power Ball, both tandem compound engines, also one 500 horse power Westinghouse cross compound engine, all condensing, have heretofore carried the load, about 750 kilowatts, requiring two 500 horse power and one 250

horse power Sterling boilers. With the turbine alone carrying the same load one of the 500 horse power boilers is cut out.

A 5,000 kilowatt Curtis turbine has recently been installed at the Commonwealth station, Chicago, where provision has been made for fourteen similar units. This machine, the first of its size, has been operated continuously for several periods of eight hours each on a water rheostat load of 5,000 kilowatts and will shortly be in commercial service. On account of water leaks around the condenser tubes, no reliable economy tests have yet been made.

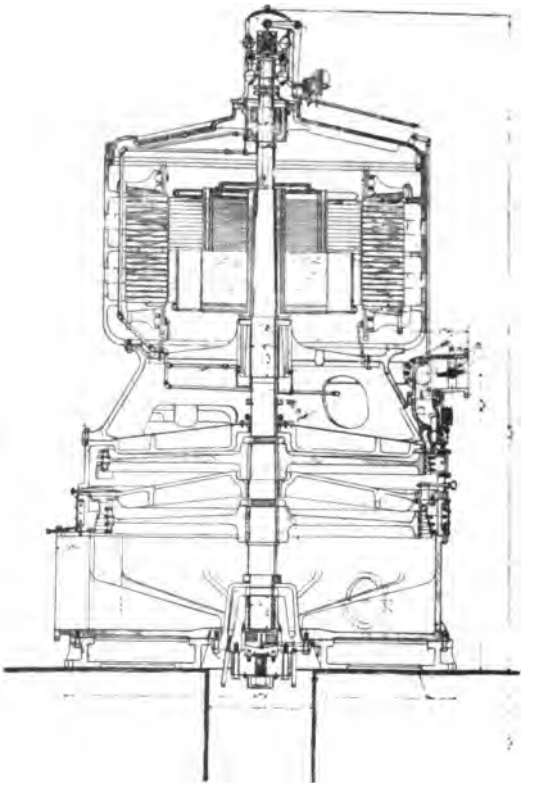

FIGURE 14. — A. T. B.–6–5,000–500–9000 VOLT GENERATOR DIRECT CONNECTED TO A CURTIS STEAM TURBINE.

In textile mills the first units to be installed are three 500 kilowatt Curtis turbines at the Lane Cotton Mills, New Orleans, and two similar units at the Fulton Bag & Cotton Mills, Atlanta, Ga.

I need not describe these plants further. A sufficient number are already in operation to demonstrate their superiority over reciprocating engines, and the extent of their installation is limited only by capacity for production. The flexibility of the electric drive for textile mills together with still greater adaptability of turbine driven generators must result in increased capacity at diminished cost.

FIGURE 15. — 20 HP. TRAIN LIGHTING SET.

The PRESIDENT. Any questions, gentlemen. Will no one open the discussion.

The SECRETARY. Mr. President, while I do not feel competent to discuss the paper critically, there is one point which will interest all of the members to know that by permission of the General Electric Company, this is the first time any illustration

or description of this development of the old principle of form of the rotary engine has ever been allowed to come before the public and although it is not the first time by any means that this Association has been in the forefront in presenting new ideas and new methods this is one of the most important development of the times, and this paper will bear the most critical reading by those interested in the subject.

Mr. CHARLES T. MAIN. I have no figures to present here but I would like to say that my partner, Mr. DEAN, has made quite a good many tests on the three principal types of turbines now on the market and found that when running under full load that the efficiency is about the same as on a compound engine. The beauty of the turbine is that the efficiency holds up on part load remarkably well, better than on the reciprocating engine.

Regarding the style and workmanship of the General Electric turbine I would say that I made a visit to the shop a few months ago and was very much pleased to see the beautiful workmanship they were putting into the machines they were building. I saw there a shop about 100 feet wide and six hundred feet long, nearly filled with turbines in various stages of construction.

Unless the General Electric Company make a success of this turbine they will be up against it very hard. The difficulties they have met and overcome and those which they will meet in the future are probably no more than have to be met in the introduction of any new invention or machine and they will be overcome.

I believe the turbine has come to stay.

The PRESIDENT. The next paper is by Mr. EDWARD ATKINSON on Mud Fuel.

MUD FUEL.

EDWARD ATKINSON, LL. D., Ph. D., Boston, Mass.

I published my hypothesis that the black mud which underlies the numerous fresh water bogs which are not peat bogs in the ordinary sense in which that term is used, many of very great extent, might become an important source of light, heat and power, before I had proved it, in order to cut off any obstructive patent claims on the conversion of this material into fuel, coke and gas. At first it seemed to me incredible that if this mud could be used in this way it had not long since been converted into briquettes by drying and into coke and gas by the customary processes. Even after my own crude experiments had been further developed in the laboratory by Professor CHARLES L. NORTON, I still only dared to suggest that black meadow mud might be converted into an emergency fuel for domestic use. I then prepared Report No. VI, of the Insurance Engineering Experiment Station, giving further details, of which report most of you have received copies and all can be supplied on appplication to myself.

This report has attracted wide and urgent attention on the part of many engineers and chemists of highest repute. I now submit a review from the " Iron Age," the most complete review yet made.

THE APOTHEOSIS OF MUD.

By James C. Bayles, M. E., Ph. D.

Under a fanciful and somewhat misleading title, EDWARD ATKINSON of Boston, as director of the insurance experiment

station, which is doing extremely good work in many lines of investigation, has written a report on "Mud Fuel, Coke, Gas and the Secondary Products of Gas Derived from Mud," which is more likely to find interested and appreciative readers than if less playfully entitled. In the field which chiefly engages him, Mr. ATKINSON is perhaps too much a man of letters to be in the highest degree successful as a scientific investigator. He loves an amiable contention, and discovers the "news value" of a fact almost before it is evolved from the nebula of hypothesis, which leads him to the expression of very positive convictions on many subjects which it does not discredit his intelligence to say he does not fully understand, since nobody else does. For many reasons it is to be regretted that he is not furnished with a ground work of accurate technical knowledge. In many respects his mental make-up is like that of Count Rumford. He chiefly values truth for what may be done with it for the immediate benefit of humanity; but, unlike Rumford, he is not an original investigator. His facts are largely gathered by experts in comparatively narrow lines working under his direction — his own function being to arrange, classify, weigh and measure such facts and bring his lively imagination to bear in finding immedidiate and practical uses for them. This function, which is more nearly journalistic than anything else, is performed by Mr. ATKINSON with great skill, and has even greater value to the world than resides in the mere accumulation of undigestcd and unemployed observations of natural phenomena. In the School of Insurance Engineering, which he founded and conducts, we have a work of permanent value to the world of which any man might well be proud.

In what we have designated as his apotheosis of mud — tempted thereto by the exuberance of his own title — we have the results of an important, practical and really valuable inquiry into the fuel value — not of mud exactly, but of peat, which may be called mud only by a somewhat violent stretch of the imagination. It is a mass of partially decayed vegetable matter, largely fixed carbon, but containing some volatile constituents

of calorific value. Whether it is or ever was mud depends of course upon what mud is understood to mean. The root of the word seems to be in doubt; but no use of it with which we are familliar warrants its application to the interlaced fibers of roots, grasses, weeds and leaf mold, which make up the body of the moss and peat bogs of this and other countries. However, this is unimportant. One may call it mud if one likes, but a qualifying adjective would be useful to distinguish it from the argillaceous, aluminous, calcareous, sulphurous and other muds of the geological classification, the fuel value of which is minus a quantity. Perhaps carbohydrate mud would answer.

The investigations of Mr. ATKINSON were the outgrowth of a very practical emergency, the anthracite strike of 1902, which in many parts of this country, and especially in New England, caused a fuel famine. It began in a very simple and natural way. When the coal strike was in full swing and a substitute for coal was earnestly desired as an industrial fuel and for the domestic requirements of the poor, he went to his country place at Buzzard's Bay. Walking in the woodland he noticed that a vigorous growth of ferns had long been decaying on top of the glacial drift, and had accumulated about three feet of black "humus." He dug some of this and took it home to be dried in an iron pan by the kitchen fire. When dry it burned very well. There was nothing surprising in this, but it suggested further investigation. The matter was turned over to Professor NORTON of the Insurance Engineering Experiment Station, and the results are embodied in the *brochure* which we have denominated the apotheosis of mud. It is interesting that the very first result of the experiments thus initiated was the acquisition near Boston of a suitable area of peat bog, from which it is expected to derive all the heat required for the effective testing of refactory and fire resistant materials available for use in constructions approved as insurance risks by the Massachusetts mutual companies.

Professor NORTON'S tests were conducted along the usual lines of practical demonstration. The material when taken

from the bog weighed from a 100 to 125 pounds to the cubic foot and resembled brown mud, with occasional twigs, roots and other intrusive stems of plants visible through it. After adequate air drying it shrunk in volume about 20 per cent., and in weight 40 to 45 per cent. Its toughness and density were materially increased by moderate pressure applied during the drying process. The denser samples compare with pine wood in hardness and strength to resist crushing strains. When quite dry it gives in the retort a firm, dense coke resembling that made from good coking coal. In coking there is some shrinkage in volume, but little or none in weight. Tests for calorific value show that the mud when "bone dry" yields in complete combustion from 9,600 to 14,000 B. T. U. per pound. This warrants the conclusion that air dried bog material has a fuel value equal to from 65 to 95 per cent. of first class American steam coal. Indeed, it would seem to be considerably better than a good deal of the coal which serves a very useful purpose in the domestic and industrial economy of the country. From the data above summarized Professor NORTON makes the following deductions:

"I think we may now with perfect safety estimate the fuel possibility of our bogs and marsh. There will still remain the question of the cost of drying, handling and coking.

"With 43,560 feet to the acre, and a depth, say, of 20 feet, we should have some 860,000 cubic feet of mud per acre. This will yield at a conservative estimate 40,000,000 pounds of air dried mud, which is equal to heating power to at least 25,000,000 pounds, or 12,000 tons, of good coal. If convenience in handling and diminished bulk will justify the coking process, we may still hope to obtain the equivalent of 10,000 tons of good coke from each acre of 20-foot bog. I leave the computation as to dollars and cents for the Director of the Station. There is almost, if not quite, enough gas distilled from the coke to make one pound of mud furnish enough gas to coke the next, so that the coking process once started will require no extra fuel.

"The coke and the briquetted mud both burn with a hot fire and leave from only 6 to 12 per cent. of soft ash. Practice has shown the coke to be excellent in some metallurgical processes and that as a substitute for charcoal in working iron it is also very satisfactory.

"Further light is needed on the cost of excavating, on the cost of equipment for drying, and the length and cost of the drying operation. We need also to experimentally determine the cost of a continuous coking operation. With these data and a determination of the depth of some of these bogs we can compute what their fuel value is, and determine what reliance can be placed upon them for an emergency supply of fuel.

From the point at Professor NORTON leaves the subject to the establishment of the practicability of mud as an emergency fuel and an important supplement to coal may be "a far cry," but not so far that Mr. ATKINSON discovers any difficulty in bridging it. He is arranging to equip a station for further experimentation in this direction, and expects to be able before long to show that in our wet meadows, fresh and salt, we have a source of heat and power of more consequence than some of important coal measures of the country, because their geographical distribution is extremely impartial. Indeed, they may be said to be found everywhere. These bogs are of two kinds—those built up of the sphagnum moss and the special varieties of mosses and ferns which grow together in wet places, and those built up of decayed grasses and weeds which grow with them. The former furnish what in this country is known as peat; the latter the meadow mud; which has been made the subject of investigation by the staff of the experiment station.

The availability of peat is not a new discovery; that of mud from salt meadows and bog lands, while long known to geologists, will come to many as a revelation. Here is a raw material of very little initial value and scarcely capable of monopolization. It is much more cheaply mined than coal, and much more safely, since it lies upon the surface or very near it. To drain the bogs, swamps and marshes and thus begin its con-

version into a useful product involves no great difficulty. If it cannot be done by gravity it may by wind power. Air drying is a slow process and involves some expense for shedding and handling. To expel the greater part of the water and at the same time compress the material into briquettes of convenient size and shape, by mechanical means, should be simple and economical. To make it bone dry by mechanical treatment would perhaps be impossible, but if all the water which pressure or rotation will expel is disposed of, air drying will do the rest very easily and comparatively short time. The shape of the briquette might greatly facilitate this, and at the same time favor rapid and complete combustion. In the dry peat, or marsh mud, what have we got?

1. A fuel comparing favorably, pound for pound, with first class American bituminous coal, very little of which yields as high as 14,000 B. T. U. to the pound with complete conbustion.

2. A smokeless fuel, the burning of which involves very little dfficulty.

3. A material from which an excellent grade of firm and hard metallurgical coke may be made, free from sulphur and lower in ash than any coke with which we are acquainted. This should be a superior forge fuel and extremely useful in many smelting operations.

4. A free burning domestic fuel as convenient as wood and very much cheaper than any kind of coal, except in close proximity to the mines.

5. A cheap source of gas, with the usual valuable by products now obtained in the coking of gas coals in retorts and from the destructive distillation of wood.

6. A source of peat meal, of which extensive and profitable use has been made in Germany for many years. It has great value in absorbing and holding ammonia and saving what without it is a great waste of fertilizing material. Air drying, with alternate freezing and thawing, will reduce to meal the uncompressed bog material without other cost than cutting and stacking it.

Very likely this list might be further extended, but it is

already long enough to attract attention and fix the interest of inventors and builders of machinery, as, indeed, it is already doing. It is not "moonshine" by any means. Granting that where coal is plenty and close at hand no other form of fuel can advantageously compete with it, the fact remains that there are vast areas of the United States where it is neither plenty nor cheap, and where the costs of transportation and distribution make it as costly as it is inconvenient. For such areas the possibilities of moss and grass peat as sources of heat, power and light are almost unlimited. In calling attention to them in the way he has done and inspiring the reader with some of his own enthusiasm, Mr. ATKINSON has added another to his many and distinguished public services. His work should bear fruit.

REMARKS OF MR. ATKINSON.

In explanation of this review my reason for adopting the title and treating this subject as I did was in order to attract attention by making it readable and also to draw out such reviews as the foregoing, so that I might assure myself that I had not been misled by an ignis fatuus.

The generation of power from coal is worked by combustion, converting the gases of the coal into what we call heat. Heat is a form of physical energy, said to come directly from the sun. I venture to suggest that this is an error. If the vibrations emanating from the sun brought the energy of heat directly to the earth, then the tops of the mountains, especially in the tropics, where the highest mountains are, would be the hottest places in the world and the deep valleys would be the coolest or coldest. The reverse happens to be true. How, then, is heat generated from the sun upon the earth? It is of course known that the whole body of the sun is in a state of intense incandescence. The photosphere is disclosed by the spectroscope, consisting of all the known substances, metal, mineral, and the like, in a gaseous condition. From this body emanate immense vibrations passing out into the ether of which we know little or nothing. As these vibrations, undoubtedly of intense heat, pass beyond the

direct influence of the incandesence of the sun, must they not become intensely cold until they approach the earth? Otherwise why would the outer atmosphere be cold and the tops of the highest mountains, even in the topics, be covered with perpetual snow? It is only when these vibrations come down into the lower atmosphere or strike the earth itself that heat is generated. How? Is not the heat generated by friction, the friction of these vibrations or undulations forcing their way through the more dense atmosphere after having passed through the ether? Where these vibrations or undulations strike vertically as in the tropics, heat may be generated not only by the friction of the atmosphere but by the concussion with the more solid earth, while in the temperate and frigid zones these vibrations striking at a more and more obtuse angle made less concussion or glance away into space without promoting the excessive friction and heat of the tropics. I do not know whether this theory will stand among scientific men. It may be in the books, and if so, I wish I had the citation. So far as it goes, it is a hypothesis of my own; not consciously derived from reading. From that heat generated by the sun we of course derive the possibilities of life, the growth of plants, the formation of mud ultimately converted into coal. The sun is the primary source of heat; friction and concussion the secondary sources.

What, then, is coal? Again I must deal with my slight knowledge of geology. We live here upon the spurs of the great Laurentian chain, called in the United States the Appalachain chain, the oldest rib of the continent. It consists of the igneous or crystalline rocks, which have been converted by heat into granite, gneiss, and the like. They are without fossils or organic remains, but contain potash and other elements of fertility in very large measure; the granite is pervaded with fossil water in hygroscopic form, which renders it so bad a resistant against fire. The small particles of hygroscopic water, being converted into steam, rend the granite into sand; so that in the basement of one of our factories where there were alternate oak and granite posts exposed to a very hot fire, the oak having been put in to supplement the granite, the latter were completely destroyed, while the oak were

carbonized only to the depth of an inch, holding up the building and saving a large loss.

We know little of the contour of this primal continent. We do know that it was flanked on the west by the extension of the Gulf of Mexico as far north as the blue grass section of Kentucky, and that the outlet of the St. Lawrence was once in that direction. We know that the ocean of that period was of very different chemical quality than the present ocean — far more corrosive. The authorities of the Boston Gas Company once consulted my old friend, Prof. T. STERRY HUNT, on the expediency of making an artesian well at the North End in order to avoid the heavy water tax which they paid on their steam plant. He told them that in this formation they might strike water, but it would be fossil water of a certain chemical quality, which would be utterly useless for a steam plant because of its corrosive quality. They were not discouraged. They put down the well; they struck the water, and it corresponded in its corrosive action to the theory of Professor HUNT. This water ate away the granite and the gneiss until gradually a soil was formed. Then followed the period of the coal measures, when plant growth of the most profuse kind passed year by year into partial decay, protected from total conversion into gas by being buried under water. This plant growth consisted of the carbon and the hydrocarbons derived from the atmosphere, and the albuminous or nitrogenous elements derived from the soil. Year by year, as one plant succeeded the other and the other was buried in the mud, the anaërobe microbes which thrive in water, but are killed by exposure to the air, fed upon the albuminoids, converting them back in the process of decay into gases and restoring them to the atmosphere, while the carbon remained, hence the will-of-the-wisp, marsh gas, etc. All this change to coal must have taken place under water in the form of mud, because when vegetable matter falls upon the surface of the ground after one set of insects and microbes, known as aërobes, which pervade the air, have disposed of the albuminous and nitrogenous parts of the plant, another set of microbes attack the rest of the decaying mass, carbon as well as other portions,

and convert the whole back into the gases from which the carbon was originally derived.

The deposits of coal are not confined to the carboniferous series or era. The great deposits of that period, consisting of the anthracite, the semi-bituminous and large deposits of the bituminous coals were subjected to the great disturbance of the shinkage of the earth's crust. The anthracite coals were subjected to an enormous pressure, which rendered volatile the hydrocarbons and left the fixed carbon, from ninety-two per cent., sometimes ninety-eight per cent. of the whole volume. The semi-bituminous coals, and the best bituminous coals, those known as coking coals, were subjected to a less measure of pressure and to a less degree of heat; they retained the hydrocarbons which are miscalled bitumen, yielding the qualities which are so well known. But as we pass west into the more recent geologic periods, we still find the process of conversion of plant life into mud and then into coal, yielding the almost level deposits of the coal of the middle West, which has been subjected to a light pressure, is friable, dirty and smoky, covered in many places by the loess, or wind formation. But not yet the end. When we reach the far West, the youngest and volcanic section of the country, here again we find that plants have grown and decayed and have formed what is known as lignite or brown coal, which in the volcanic uplift has been brought to or near the surface, the water draining away, leaving it a friable, carbonaceous material, containing twenty-five to thirty per cent. of water in the hygroscopic form, and when compressed into briquettes making a good fuel. Lignite is nothing but fossil mud.

Again, all over the Southern states, Alabama, Mississippi, Louisiana and Texas, where for geologic ages must have been great mud lagoons while the water was receding, there are immense lignite formations from which there may be hereafter derived a clean, smokeless household fuel, possibly or probably without the necessity of adding any tarry or bonding material to the lignite. That is a question of mechanics. But we have not come to the end of the coal and lignite measures yet. We may

now come back to the modern period, the alluvial, and again we find plants growing, decaying, forming great, deep bodies of mud protected by water from the destructive organisms of the air while the anaërobes are consuming the nitrogenous portions, converting them into gas which bubbles up in the bogs, marsh gas and the like, passing on for conversion and reconversion throughout the ages. All things have been gas — all things will be gas. That process is going on in Massachusetts over great areas; and here is probably the first specimen of mud — clean slimy mud, much more free of fibres than peat — which has ever been converted into fuel from the mud of the sluggish Taunton River, or from any other mud in the United States, although the peasants of Ireland have been making and burning mud briquettes for generations.

There is no subject of greater importance to the textile manufacturers than to lessen the cost of heat, light and power, especially if my conviction is well grounded that the wasteful steam boiler and engine will soon give place to the gas engine for all stationary purposes.

I may now venture to say that from the time when I first turned my attention to this subject and it became plain that all coal had once been mud and that modern science and invention might become a substitute for converting mud into fuel in place of the lapse of geologic ages, I have felt great assurance that my hypotheosis would be justified in practice even on a revolutionary scale. I reasoned that all the different kinds of coal beginning with anthracite, had been forming in successive geologic periods from the carboniferous age down to the formation of brown coal and lignite in the more recent geologic formations on the Pacific Coast and also in the Southern States. It, therefore, became obvious that this black mud of the modern alluvium could be nothing but coal in its primary process of formation. Since this theory and our laboratory experiments have been sustained by men of highest authority in engineering, in physics and in chemistry, all that now remains to be done is to invent or improve mechanical appliances and gas retorts, and to devise

the latest costly methods for placing this immense source of energy at our disposal at a low cost.

None are more capable or in a better position than yourselves to develop this theory and none have a greater interest in doing so. I therefore, suggest to every member who has in the neighborhood of his works a fresh water mud bog or a great salt marsh deep in mud at some distance from the influence of the tides, to send out some lime casks or barrels with holes bored in the bottom for drainage; fill them with mud; leave the top open but protect with a few boards to keep rain off, and after six or eight weeks move to your works. You will probably find a nearly solid mass of dried fuel from which you will be obliged to cut away the casks or barrels and then to cut up the material with an axe. It will probably be necessary to give more time for air drying the blocks after the large masses have been cut up. It can then be distributed among the households to test for domestic fuel. Those who have chemists in their employment may determine the conditions, the remaining water content, — the quality and character of the gases and other matters. Those who are making water gas may put some of this material into their retorts to find out whether or not the hygroscopic water mixed in the carbon may not be dissociated more readily than the common mixture of anthracite coal and water, and whether the marsh gas developed may not make an illuminating gas without the need of mixing naphtha with it to enrich it. It will at least make a heating gas for gas engines.

I hope this may attract the attention of the members of the Association and I request any who may make experiments of any kind to report to me what the results may be. It it probable that the mud of different bogs may vary in some measure and it is also important to know what the quality of the black mud of salt water bogs may be when it is taken far enough away from the flowing tides to be free from silt.

I shall now appropriate the small necessary sum to have samples of mud fuel chemically annalyzed under the direction of Professor NORTON, in order to determine the kind and quality

of the gases and of the secondary products that may be derived from it.

At that point we must rest until we are supplied with two thousand or three thousand dollars with which we may put up works of sufficient capacity to prove our laboratory tests in actual practice by tons in place of pounds.

We have not solicited contributions to the experiment station but in reply to my statement of its purpose many members of the factory mutual system made a voluntary assessment at the rate of half a cent on each hundred dollars of their risks more or less, to the amount of about thirteen thousand dollars ($13,000). We have also received about three thousand dollars ($3,000) from other sources. As this money was intended to be applied to problems of construction on so-called fire-proof methods and materials and to other matters directly affecting fire insurance, we only felt at liberty to apply a very small sum by consent of special contributors to the development of mud fuel. We want more money for this purpose as well as for our general purposes.

Any members of the Association or others who desire information on the quality of the mud in neighboring bogs may send a nail keg or firkin filled with mud taken from below the sod. Send by express, prepaid, to Professor CHARLES L. NORTON, Institute of Technology, and remit to me ten dollars ($10). After a sufficient lapse of time for drying a report will be made. Each parcel shall be accompanied with a statement in the following form:

1st: A general description of the bog.

2nd: Depth of the mud if it can be ascertained by sounding.

3rd: Depth below the surface from which the sample has been taken.

4th: Weight of the parcel when first filled from which we may reduce the shrinkage in drying.

Add any other remarks that may be suitable.

For information of members of the Association who are not yet interested in the experiment station, the following list of reports already made, or about to be made, is submitted:

No. I. Fire-Proof Wood, so-called.

No. II. Sound-Proof Partitions.

No. III. Wired Glass — Diffusion of Light.

No. IV. Corrosion of Steel.

No. V. Slow-Burning or Mill Construction.

No. VI. Mud-fuel, Coke, Gas.

No. VII. Fire-Resistant Roofs for Foundries and Machine Shops.

No. VIII. Diffusion of Light.

No. IX. Second Laboratory Report on Corrosion of Steel.

No. X. Test of Columbian Fire-Proof Construction.

No. XI. Test of Fire-Resistant Quality of Luxfer Prism Glass set in Copper Framing.

No. XII. Non-flammable wood prepared by a new process which promises success.

Any architect, engineer, mill constructer or other person not directly interested in special works may receive these reports from the beginning up to October 1st, 1903, including the above list, upon remitting ten dollars ($10) to the undersigned. A renewal of the subscription may be made for the next year at the same rate in which second year we shall be able to extend our tests from those of a small laboratory to tests made in large buildings which several representatives of steel and concrete construction are ready to put up. In these buildings we may also test the fire-resistant properties of doors, shutters, glazing and of many kinds of incombustible inside finish which we are now being offered. We shall also test the corrosion of steel by observations taken from month to month as the different methods of protecting steel stand exposure to the weather and to lapse of time.

In this period of two years from the beginning of our undertaking we expect to find out what a course of instruction in

insurance engineering ought to be. We may then lay out such a course on the basis of our experience and secure its establishment, probably in the Massachusetts Institute of Technology, as a necessary part of the technical training of all students who are preparing for the practice of architecture, as mill constructers, mechanical engineers or other work in which the prevention of loss by fire should be regarded from the laying of the foundation to the completion of the works.

It is propable that at my advanced age this will be the last of the many suggestions that I have made to you somewhat out of the beaten track.

I have put before you right methods of cooking food in the Aladdin oven in the most nutritious and least costly way; an invention which has been justified by hundreds, even thousands of witnesses, but which has remained for a colored man, BOOKER T. WASHINGTON, to put in practice on a large scale. He once came to me for advice, saying that in order to raise his people to a higher plane he must teach them to live better. I said, "What do they now live upon"? The answer was, "What you call hog and hominy, corn meal and bacon." "Why not beef"? "Because the Alabama beef is so tough it cannot be eaten." "Why not mutton"? "The mutton is worse." "Then," I replied, "cook them properly and make them tender, nutritious and succulent." I drew for him an Aladdin oven of five lamp power, to be made of pine plank, plastered inside with mortar upon wire lathing, metallic bottom, with holes for the heat of the lamp to go in and for the products of combustion to come out; within that a large sheet iron oven to hold the food in the process of cooking, there being no direct communication between the source of heat and the inside of the inner oven. In such ovens the tough and stringy Alabama beef and mutton are now cooked slowly all night, yielding tender, nutritious food, with all the juices saved. The corn bread and yams, the bacon and meal are cooked in the same way, with the least work and the best and most wholesome results. All the students, more than a thousand in number, have thus been raised in the plane

of education by suitable attention being given to the science of nutrition.

From the tables of your boarding houses and of your operatives enough good food is now sent to feed pigs, which if combined with the scraps from the butchers' tables which are sent to the soap boilers, would give better nutrition, more appetizing and more wholesome food than that which is consumed on the tables by your operatives. French and Italians would get more abundant and better nutrition out of this waste of material than the people of this country get out of the damnable American frying-pan and the infernal iron stove in which the material is either spoiled or rendered unwholesome by the application of excessive heat.

I have developed the right method of diffusing light in your factories and workshops, enabling you to make more and better cloth and saving the eyes of your operatives. Would it not be well for you to force this subject upon the attention of the school committees and superintendents of your cities and towns, in order that the light in the school houses may be equal to that in the factories and shops and that the eyes of the children may no longer be rapidly impaired as they are now being, from the bad lighting of nearly all the school-houses?

I have now put before you the hypothesis and the apotheosis of mud which may work an evolution, even a revolution, in the source of heat.

If by these almost accidental discoveries I have made a contribution to future welfare, I shall have in some measure requited the world that has used me so well, and have rendered a service to you whose agent I have been these many years to your profit and to the saving of loss by fire, often brought about by methods which have sometimes irritated you but which I have justified by saying that my function was that of the "Spanish fly" or "porous plaster", a wholesome irritation in order that you might make the necessary improvements in your risks.

To turn to mud fuel. I am now learning once more that there is nothing new under the sun. Mud fuel has been made

in this country by several persons and even been converted into coke; but none of those who claim to know all about it and who have practised the art. have appeared to realize its immense significance, or else they have desired to keep their information for their own personal profit. I, therefore, yield my claim to discovery in this country, reminding you again that Irish peasants have been making fuel from what they call "turf" for generations. But no one seemed to have dreamed the extension of this art in Ireland until Lieutenant-General Sir RICHARD SANKEY, K. C. B., R. E., took it up and published an article in one of the reviews at the very time I had begun my investigations. Even he does not appear to have thought of coking the briquettes, and yet my son's coachman, once a blacksmith in Ireland, tells me that he used turf-coke on his forge many years ago.

It is strange that many important ideas are delayed for years in their application for want of publicity. I am not made that way. When I strike a new idea it takes possession of me, nor would it be consistent with my position as the Nestor in the factory mutual system to keep my crude discoveries or inventions for my personal profit. I am the agent of the members aud I, therefore, publish every crude idea even before it has been worked out, in order to cut off what I have called piratical bottom patents on subjects which are mere happy thoughts and which have involved neither time, labor nor long continued mental energy in their development. I do not think such accidental discoveries are entitled to letters patent.

I had a happy thought in the development of the automatic sprinkler. I invented one which was of no practical value and I published it. I applied the same device to the release of the automatic fire door which I also invented and published. One element in this device had not been covered either by the Grinnell or the Walworth patents, in both of which at that time levers were used. A few years later when there were millions of these sprinklers in place two Western men purchased letters patent that had also been granted on a worthless and rejected

sprinkler in which the lever was covered. They entered the case in Cincinnati and obtained a decision of the District Court in their favor, attracting little attention. They then entered suit in Chicago for the purpose of collecting royalties. Then the other sprinkler manufacturers waked up. Their counsel came to me. I called for a copy of the patent on which the lever had been covered. It was one year subsequent to my publication of my own worthless sprinkler and of the successful release of the automatic door. That of course ended the case which would have put many of you or your predecessors to a great deal of trouble and litigation and might have cost the sprinkler manufacturers or their customers a very large sum of money.

I also had the happy thought that if light could be concentrated in the Freznel lens by means of prisms that light might be diffused by a reversal of the same prisms and curves. I proved this and I published it and by that publication I have broken three or four subsequent patents which might have subjected you to endless annoyance. In one or two other lesser cases I have cut off patent claims which might have been troublesome.

As soon as I conceived that ordinary black, slimy meadow mud was coal in its first stage and that if it could be freed from water it might make good fuel, I published the fact at the risk of possible derision, such as has sometimes been my fate on my previous inventions; but I never lost anything yet by being afraid of making a fool of myself. In this case I have received such unexpected scientific support at the very start as to give me a thrill of doubt about the results. I have not yet received my expected compliment. When I first served a choice game dinner cooked in the Aladdin oven in the dining-room alongside of my table, excelling the most skilful chef of the *cordon bleu*, as any one of you can, one of my previous sceptical guests remarked "Ned, that is so simple nobody but a fool would ever have thought of it." When Professor NORTON had converted himself in the matter of the diffusion of light, having been previously a profound sceptic, he was experimenting in a large hall lined

with dark wood, at the Institute of Technology. A sceptical Professor of the neighboring Harvard Medical School came in. It happened to be when the big hall was very dark, the only light coming from a twelve-inch plain glass window. He almost broke his shins as he stumbled on his way to the centre of the hall and then Professor NORTON turned a flood of light by throwing in the pane of ribbed glass. This distinguished oculist at once exclaimed, "Why didn't some donkey think of that before ATKINSON?" Is there not some one here who can give me a similar compliment on mud fuel?

With this I leave the subject to you, hoping that our experiment station will at once be supplied with the money to put up a small fuel and coke works from which we may turn out the product at a ton a day instead of a pound a day in a laboratory.

At this date, Nov. 14, 1903, when the final proofs of the report of the Cotton Manufacturers' Association are before me for correction, I have to report very rapid progress in what may now be called the applied science of converting marsh mud from fresh and salt water meadows, that are not peat bogs in the ordinary sense in which that term is used, into effective fuel. An engineer of high repute and ability, Mr. H. H. WOTHERSPOON, Jr., 150 Nassau Street, New York, has lately returned from an exhaustive investigation into the manufacture of fuel on the continent of Europe. While as yet no records have appeared in print or in consular reports of the rapid development of what I named originally Mud Fuel and now term Bog Fuel, it yet appears that during the last two years attention has been turned in this direction, the art has been developed, and the mud bogs of Holland, of some parts of Germany, and yet more of Russia, are being worked commercially on an extensive scale for the supply of what is in fact artificial coal, resembling it in appearance, in specific gravity, in heat units and in effective service. Samples, figures and proofs of this are upon my table in this office at 31 Milk Street, Boston.

The secret of conversion has been solved. Heretofore we have assumed that there might be questions on physics, chem-

istry and mechanics to be solved before this work could be established on a commercial scale, and that compression and possibly a bonding material other than that derived from the mud might be necessary in the conversion. The practice in Europe has developed the fact that in this mud there are forms of hydrocarbon in particles distinct from the fixed carbon which forms the great body of the solid in the material. These hydrocarbons are of the nature of starch or glucose, and when the mud is worked mechanically these particles are broken. The adhesive hydrocarbon then distributes itself throughout the mass, which, being moulded into the form of briquettes or blocks at once begins to lose the water content by rapid evaporation without artificial heat; the mass contracts and becomes in many instances as solid as ordinary bituminous coal. So dense and hard are some of these blocks now being made commercially in Holland that they have been substituted for bricks in the repairs or construction of their brick roadways. These hydrocarbon particles have been named in Germany Protozane. They will be investigated by our chemists. These bricks of artificial coal are made in Holland at a cost of less than one dollar per ton.

The machine in which the working of the mud is done appears to be a rather costly and clumsy counterpart of the machine which the writer invented in 1867, for working peat into fuel for the supply of the boilers at the Indian Orchard Mill. It would now appear that I accidentally applied the breaking up process to the hydrocarbons in this material, but that I did not then comprehend its importance. I now recall the fact our fuel dried in the air much more rapidly than the blocks of peat cut out with a spade and stacked up for fuel without being worked. Moreover, it held its shape and condition, and there was no difficulty in feeding the boilers without any considerable waste in handling. It also appears from our test that while ordinary peat fuel, and while some kinds of fuel now made from peat by compression the dry material without previously working, will soak water, the briquettes made from the mud after it has

been worked mechanically do not absorb water but remain even more free than bituminous coal from such absorption. There is, of course, a certain percentage of water in all this material, in the hygroscopic form, but not enough to prevent its being a most effective fuel.

Our purpose in bringing public attention to the potential of bog fuel has been accomplished. The subject is now being taken up in many places by divers people and by the application of different methods, some of them on a commercial scale. It will not, therefore, be expedient or necessary for the Experiment Station to build special works merely to prove the possibility of converting mud into bog fuel on a commercial scale at low cost. We may develop a fuel and gas plant as a part of our future undertaking in testing various types of concrete and other buildings by heat and by fire.

In conclusion, we may, therefore, feel justified in having called wide public attention to the fact that in our bogs of mud, both fresh and salt, which had not previously been considered of any fuel value in this country, we have a vast source of power, light and heat. We may feel justified in considering it proved by our laboratory experiments and by the evidence abroad that New England and many other sections of this country distant from coal mines, are in possession of material that can be converted into domestic fuel at lower cost than any coal can be secured and in many respects of better quality for cooking and other domestic purposes.

We may be justified in considering it proved that in this material we have a source of supply of gaseous fuel and of materials for conversion into water or producer gas at low cost, of the most effective kind.

We may be justified in considering it proved that this material can be converted into coke at a lower cost and of purer quality than any other fuel that can be obtained in New England and in many other sections for the finer processes of metallurgy, possibly tending to restore many branches which have depended on charcoal, now embarrassed by the scarcity and high cost of that material.

We may hope to be justified in our expectation that in this bog fuel we have a source of energy that may be applied in large plants on an extensive scale wherever coal is now required.

The PRESIDENT. Gentlemen, the next paper by Mr. DANIEL CLARK is on Blending of Cotton.

* BLENDING OF COTTON.

DANIEL CLARK, Frankford, Philadelphia, Pa.

Among the many little points that go to make up the sum total of accomplishments for a mill manager, the art of blending cotton is by no means the least.

In the making of yarns of medium numbers, say from 40s. to 90s. for the thread, hosiery and knit-goods trade a good knowledge of blending may be deemed a necessity, for there are numerous opportunities in which a manager can save for his company more than his salary for the time being, by the proper manipulation of the different types of fibre which are usually selected for these kinds of goods in that range of numbers.

Of course there is no known mathematical formula for blending and as to just how it should be done or just where it should begin is a question upon which many good men differ, as the judgment of men will differ, but a good cotton spinner with a fair knowledge of the effects of chemicals for bleaching and dyeing on the fibre should be able after a little practice to proceed without much difficulty.

Where yarns for bleaching are needed, it would not be advisable to blend or to allow any but the most spotless of fibre to go into the mix and the same rule would apply to stock from which goods of particularly bright or delicate tints were to be made, but for unbleached or for dull or heavy colors it can often be done with a saving that well repays the effort.

* For further references on this subject see Transactions as follows: Vol. 57, p. 100, E. W. ATKINSON.

As each lot of cotton differs in texture, spirality, lustre, etc., from every other lot of cotton, the judgment of the individual must be the arbitrator on the question of stock, but the proper place to begin blending is a subject which wlll perhaps bear discussion.

Some contend that the only place to begin is at the picker and there is no doubt or question but that commencing at that point the most thorough mixture can be obtained but I have known of instances where for some reason it was impossible or inconvenient to begin at that point that good blends have been obtained commencing at the drawing or at the sliver lapper when the stock was to be combed.

The object of blending cotton is to produce from two or more different kinds of cotton a stock which will be better for certain purposes than any one of those kinds or varieties alone.

For instance, Combed Egyptian Cotton of the type known as Bamia 1⅜ inches staple should make good number 60's warp or thread yarns: it draws well, takes twist well and has a good lustre but it is not as strong as some of the other types of Egyptian or some grades of American Cotton of equal length, but when blended with a certain percentage of American Cotton of the type known as Vicksburg, a strong cotton but lacking somewhat in spirality and lustre, it produces a better yarn for the purposes named than would either kind alone have made and at a less cost than that of the higher priced of the two kinds. It draws well, takes twist in the roving well and spins into good, strong, even yarn.

Another instance; a lot of cotton selected for 80's warp yarn combed stock 1½ inches in length, clean and strong, opened well, drew quite hard but spun well but in the dressing failed to take size well which caused trouble in the weaving but when this cotton was blended with a stock of equal length but of more pliability this trouble was overcome and the finished fabric was satisfactory and produced at a slightly reduced cost than if made wholly from the stock as originally used.

Now there are some, and capable men no doubt, who think

that there is nothing in it, or it is adulteration at best, but if questioned most of them will admit that they have never tried it. As for adulteration, how much is bought in the way of supplies, oils, dye stuffs, soaps, etc., that has not undergone the process of blending. Question the manufacturers of those goods and they would probably tell you, and truthfully too, that the process was necessary to produce an article of merit. The popular Sir Thomas Lipton would probably contend that the blending of tea is a fine art and necessary to produce certain flavors; and such is the case with coffee, spices, and many other articles of commerce. Why, then, should not the fibre upon which we work and which we know possesses such vast capabilities, why should not that too be blended, and be improved by the process?

The PRESIDENT. The next paper is Adjustment of Preparing and Spinning Machinery by Mr. EBEN C. WILLEY, Boston, Mass.

THE ADJUSTMENT OF COTTON PREPARING AND SPINNING MACHINERY.

EBEN C. WILLEY, Boston, Mass.

MIXING COTTON.

The necessity of a thorough mixing and blending of the several grades of stock, and lots of the same grade is very important, and particularly so in those mills which use from St. Low to St. Good Middling Cotton, and which show a varying length of staple; there is also a wide difference in the character of cottons which make it absolutely necessary to have uniformity in mixing, in order to be assurred of a successful beginning in the manu facture of cotton yarns.

It is not unusual to find in the different lots of cotton of same grade, a variation in the strength of staple, which is as serious in its results as irregular or short staple cotton, and should be examined for its strength the same as for staple and grade in the redrawn samples, for it is as readily detected.

Strong, even fibered cotton shows its effect throughout a mill in less loss in waste, good running work and strong even yarn, with a maximum product from the spinning and weaving.

Uneven stapled cotton would show great variation in the yarn and breaking strength, poor running work and a general loss in product and quality, and as nearly all mills would find one or several lots among the many used in the course of a year, they should be carefully mixed with other lots of better staple, and

the same rule would apply to the weak or tender staple cotton.

To get the full benefit from the mixings of the several grades of cotton they must be uniform, whether for a daily or longer run, and the character of each mixing governed by the preceeding one, so that there would be the least possible change in the average quality of cotton going into the mill. This can only be accomplished by some responsible person who has a general idea of what is required, and the results obtained by good judgment and attention to details in this matter, would be surprising to those who have not given it careful consideration.

A thorough mixing cannot be too strongly insisted upon if the best results are desired, as an indifferent mixture, if several grades were used, would be readily noticed both on the pickers and cards, as neither of these machines can remedy an irregularly made mixing; it will also show its effect in the variation of the numbers of yarn and quality of same.

Table below gives an illustration of a series of mixings which can be followed indefinitely, of 1,000 bales of cotton divided into 11 lots, 50 bales to each mixing.

Mark.	No of Bales.	Grade.	Staple.	Strength.	Color	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Remaining.
ADE	100	St. G. Mid.	1 1/8	Strong	White	10	10	10	10	10	10	10	10	10	10						None
BCD	100	St. Mid.	1 1/16	Fair	"	10	10	10	10	10	10	10	10	10	10						"
HFCE	100	St. L. Mid.	1	"	Tinged	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	25
BOD	100	St. Mid.	1 1/8	Strong	White	5	5	5	5	5	5	5	5	5	5	10	10	10	10	10	None
HOG	100	" "	1 1/16	Weak	"	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	55
COL	50	" "	1/8	Fair	"	5	5	5	5	5	5	5	5	5	5						None
DOCH	50	" "	1/8	Strong	"	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5
TIL	100	St. L. Mid.	1	"	"	5	5	5	5	5	5	5	5	5	5	7	7	7	7	7	15
HYC	100	" G. "	1 1/8	Fair	"	5	5	5	5	5	5	5	5	5	5	10	10	10	10	10	None
THN	100	" Mid.	1 1/8	Strong	"											5	5	5	5	5	75
NIP	100	" G. Mid.	1 1/16	"	"											5	5	5	5	5	75
	1000																				250

PICKING.

On the condition of the cotton in its raw state ready to be fed into hopper of feeder, depends the success of the first operation

in cotton manufacturing, and if several grades are used, properly mixed and broken into medium sized pieces, the various grades ·ose their character and the cotton becomes an average of the several grades.

The ordinary hopper will hold from 75 to 100 lbs of cotton, and supply in same should be kept as near uniform as possible consistent with economical handling.

The opening machines built by the different firms are in several styles, but the opener built with the rigid or three arm beater seems to accomplish the best results, both in taking out the heavy foreign substances and leaving cotton in better condition for the succeeding beater, or, if the trunk system is used there will be more sand and leaf collected in pockets of same.

Cotton should be delivered to opener beater heavy enough to induce a blow from beater which would be noticeable in character, for a light feed at this point results in a poor beginning and overloads the work of the following machine.

The cleaning trunk is not absolutely necessary, but is of great advantage in taking out the sand and undesirable matter, particularly on low grade stock, which has a high per cent. of dust and leaf.

The Breaker lapper following the opener receives the cotton on the cages or from a gauge box, and same rule should be followed here and feed heavy to the beater, so as to get the full centrifugal force of the beater to act on the cotton; by doing this you will obtain a clean action of the beater at feed rolls, better separation of the cotton and an evener delivery to cages, with the result that the lap delivered will be of uniform thickness.

Laps from a machine if 40 inches in width should weigh not less than 18 oz. per yard, cotton 1⅛ inches in length or less.

Care must always be taken that feed rolls hold cotton securely, and that beater is set close enough to feed rolls so that cotton will not over lap and close space between top of grid bars and rolls, for in this space 75 per cent. of the cotton cleanings are thrown out, as it is not the action of the cotton on the

grid bars which throws out the foreign matter, but the contact between beater and feed rolls, and that which falls through grids does so by gravity after the beater has performed its work.

The Intermediate lapper is a duplicate of the first lapper, excepting it has an apron for doubling several laps and an evening mechanism. Four laps is the usual doubling and as 72 ounces would be weight per yard delivered to beater, care should be taken to have sheet firmly held by feed rolls, and beater set so that action will be the same as on preceding machine. The lap from this machine should weigh about 16 oz. per yard.

The Finisher lapper is a duplicate of the Intermediate machine.

The essential features of the preparatory machines or lappers is to prepare a clean uniform sheet of cotton, free from impurities, for the cards, and to do this in the best possible manner under all conditions.

To do so we must look to the beater, and

First. Run it the speed required to get the proper centrifugal force.

Second. Set correct distance from feed rolls for work required.

Third. Regulate weight of cotton to get best results.

Fourth. Keep inside of machine clean and not allow chamber under beater to become filled with droppings.

Fifth. Machine should be kept well oiled and all parts working free, particularly the evener.

Regarding the speed of beaters, the best results have been obtained by running the opener beater 1,100 to 1,200, and the following beaters from 1,400 to 1,500 revolutions per minute and set respectively in their order, beginning with opener $\frac{3}{8}$ inch, $\frac{1}{4}$ inch $\frac{3}{16}$ inch, and $\frac{1}{8}$ inch, although conditions would vary somewhat in different mills. A beater gives the best results when edge is slightly rounded.

The heavy feed reduces the speed of delivery to beater, consequently gives greater action for play of the beater on the cotton, separating the flakes of cotton and knocking out the foreign

matter, also giving a more even delivery to cages owing to the cotton being better opened.

It is very important that the chamber under beater should be as near a dead air space as possible and is regulated by the draught; so that the light leaf will not be drawn back again by suction of the fan through grid bars, and the best way to overcome this, is by a 2½ inch to 3 inch space between top of grid bars and bottom feed roll.

There can be no set rule for speed of fans, on account of the different conditions governing location of dust rooms and size of outlet from same in the various mills, but should run fast enough to overcome any back draught.

The Kirschner carding beater is a great improvement over the knife blade beater for finisher lapper, and prepares the lap for the card without injury to the fibres, cleans the cotton better by eliminating more of the fine leaf, and delivers cotton to cages evenly, so that lap is uniform in thickness and does not show the thick and thin places, as can be readily seen in a lap from knife blade beater, at the same time less cotton is thrown out with droppings.

If the best results are desired, the lapper should receive the same care and attention that is given the cards, both in setting and general over-sight, and the same examination should be given the sheet of cotton from lappers occasionally that is given the carding, as it is fully as important, and when this is done systematically a great improvement would be noticed in the work from these machines, always having in mind, however, that a heavy body of cotton delivered to beater insures a much cleaner and evener lap for cards.

Would suggest that hard wood gauges be used for setting beaters, made 2 × 10 inches and $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, and $\frac{3}{8}$ inch in thickness, this would allow for a wide range in setting to suit the various conditions, and would eliminate the haphazard methods now in general use.

CARDING.

Good carding is recognized by all manufacturers to be absolutely necessary, in order to get quality and product from the after processes to the spinning of the thread which determines the texture, character and appearance of fabric to be woven, although it is not unusual to find one or more of the succeeding operations through which the cotton passes, either through neglect or wrong arrangement of drafts, undoing which otherwise would have resulted in an even, strong thread being produced.

Upon the sheet of cotton that is fed to card cylinder depends to a great extent the nature or quality of the carded sliver, and the picking should receive the attention it deserves, but too often the card is blamed for poor work caused by carelessness and a mistaken idea that if the laps are delivered from picker room in a presentable condition it is all that is required.

Card grinding, setting and care of the wire requires good judgment and the exercise of intelligence equal to that necessary in a good loom fixer, but the fact is often lost sight of, it being so far removed from the finished product. In grinding, extreme care should be taken not to grind too heavy and hook or turn over the points of the teeth on doffer or cylinder, for the smoother the wires the freer their action and delivery of cotton. Medium heavy is preferable to either very heavy or light grinding, and two to three hours is long enough under ordinary conditions, although number of emery whether coarse or fine enters into the matter to some extent. The top flats should be ground heavy so as to form a rough point, which is desirable, inasmuch as roughness is a factor in the wire holding the short stock and leaf. Setting a card, if properly ground, requires fine adjustment and careful attention to details and whatever the style of card, the gauges should be of the standard sizes in sets of three, including the $\frac{7}{1000}$, $\frac{11}{1000}$ and $\frac{15}{1000}$. It is often the case that card grinders use a gauge of their own manufacture and one size answers for all purposes. All doffers and cylinders should be set with the $\frac{7}{1000}$ gauge, whether of the old common

top flat or English pattern, and can be accomplished if cards are properly clothed.

Top flats if set with the $\frac{11}{1000}$ gauge, will be close enough for all practical purposes, and this should be insisted upon even with wooden flats, although it may be necessary to change the setting of an odd flat or two on cards in damp weather, and all flats should be set the same distance from front to back to get the full benefit of the carding surface, for with the improved picking that has been secured in recent years there is not the liability of the first flats getting overloaded with the leaf and motes as formerly. Lickerin and feed rolls should be set the same as flats. The merits of the various numbers of wire, setting, round or side ground, fine or coarse, it is not necessary to give in detail, only to say, a difference of two numbers between doffer and cylinder, flats clothed same number as cylinder, has given excellent results.

What card drafts will give the evenest and cleanest sliver free from nits? The same rule holds good on the card as lapper, *i. e.*, heavy lap and a long draft. For a 40 inch card a 16 oz. lap is not an extreme weight with a card draft from 120 to 140, according to the weight of sliver required, although cotton must be firmly held at feed to prevent cloudy carding, and very few cards are weighted heavy enough at feed rolls even for a lighter lap. The advantage of a heavy lap is a slow feed, which gives the lickerin or cylinder a longer time to separate the fibres, and loosens the leaf so that same will either be thrown out by lickerin or taken up more readily by the top flats; the strippings will show a change in appearance both in increased amount of leaf and dust, with result that card sliver will be cleaner and whiter; the strips will also show a greater percent of short fibre and less long. A light sliver and quick running doffer is by all means the best method, as weight of sliver represents the amount of excess cotton being carried by cylinder, always providing the card is properly set; an overloaded cylinder is sure to cause more or less nitty carding, at the same time fills the card teeth of flats and retards their action on the fibre.

The top flats act like a series of combs on the fibre in straightening same and laying them parallel on cylinder, to be delivered to doffer. It is very important that top flat clothing be kept in the best possible condition. The product of a card is governed wholly by conditions, and depends largely on the quality of the picking and stock used, but a heavy lap and long draft ought to give from 10 to 20 per cent. greater product than a card arranged for light lap and short draft, and do proportionately better work.

RAILWAY HEADS.

By the introduction of the revolving flat card and improvement made in eveners on lappers and advantage gained by the three processes in picking on the English system, the above machine is not so necessary, although it is used to some extent in the place of one process of drawing. The important features in connection with this machine are three in number — draft, rolls and evener. On the American system of carding the draft would be about one-half the doublings, usually less, while if used in connection with the English system owing to the difference in the usual weight of slivers, the draft nearly always equals the doublings, whether they be six or eight, and no card sliver can be drawn excessively and be even, also no amount of doublings will overcome extreme draft at this point, and an evenly drawn sliver is of more importance than doublings. The draft between the rolls should be given attention and divided with reference to the bulk between same as follows: the two back rolls 1.06, middle rolls 1.60, balance between the two front rolls, which increase or decrease by the variations or weight. The top rolls, if leather covered, should be kept true and even in size and evenly weighted, and a daily examination should be made of the individual saddles and rolls to see that same are working properly; an irregularly weighted or powdered roll causes mischief that cannot be remedied by any future process.

The evener must be sensitive to a slight movement of the trumpet either backward or forward of its center, and a smooth

selvage with evenly drawn sliver delivered from rolls, insures an easy movement of evener with a quick adjustment to any variation in weight. A flat hole in trumpet, particularly if sliver is heavy, prevents the core which is formed by an oval hole, and is drawn more evenly by the next set of rolls.

DRAWING FRAME.

There is no machine in a cotton mill which requires such watchfulness and care as the drawing frame, and there is no machine which will give a greater return for this attention, as many broken threads on the spinning frames and weak places in the yarn, can be traced to an imperfect drawing sliver, and the causes are poorly covered, powdered cloth under leather, uneven, badly weighted and dry rolls, and frames should be carefully inspected several times daily, and the condition of the slivers noted from each delivery.

Rolls should be kept true and even, and the only sure way is to test them by gauge, and if shell and more than one boss to an arbor they should be matched as to size, otherwise they will not draw evenly and sliver will show a cut or uneven place.

The draft between the rolls should be arranged as in the railway head, and any change in same ought to be made between the two front rolls.

Owing to the bulk or weight of the several slivers, the total draft of a drawing frame should be comparatively short, and as in the railway head, doublings should be sacrificed in favor of a short draft, a doubling of six with a six draft will not give as good results as a five and five draft, on the English system of drawing.

On the American system of a heavy sliver on first process of drawing from railway head, and doubling three or four into one, the draft should not exceed 3.25 and 3.75.

Slivers should be condensed uniformly and hard enough to prevent stretching while passing to the succeeding set of rolls, particularly when roving can is nearly empty.

SLUBBING FRAME.

As the slubber is the first operation in the process of spinning that receives the twist, it becomes the duty of those who have charge of these machines, to give them the most careful attention, particularly in regard to the draft, rolls, spread of the top rolls, twist and tension.

The same idea applies here as at the drawing frame, and the bulk of sliver must be considered in relation to the length of draft, and same should not be over 4, and less if possible, with a difference of one tooth in draft between back and middle rolls. The top rolls are usually arranged with back and middle solid, front shell on all fly frames. Extreme care should be taken to have the two shells perfectly matched, and have rolls covered even as it is often the case that a roll may be larger at one end, and the only way to overcome this is to have rolls buffed true at the time they are covered, this also overcomes any slight defect in the lap and insures a perfectly round roll. The spread of rolls should be attended to by the overseer personally, and spread only sufficient to draw the sliver evenly, and is goverened by weight and length of staple.

The twist should only be enough to insure good running work and roving strong enough to unwind in creel of succeeding machine without breaking, but too often extra twist is put in to overcome poor work on the preceding machines, or when frames are run at high speed; a reduction in speed and change of several teeth, in twist, has been of benefit in some instances.

The sliver traverse ought to be as long as possible, with dwell at return reduced to a minimum.

A regular system should be adopted for examining top rolls, oiling and cleaning.

The tension on a slubber must be closely watched and a tight tension avoided, otherwise the sliver will be drawn enough to cause weak places which will show in the yarn, although not enough to break down the ends unless same is excessive.

Variation in weight of drawing frame slivers are a source of annoyance and seriously interfere in getting the best results if not

attended to, by keeping the laps or railway head slivers uniform in weight. Light or single drawing slivers must be eliminated, as they interfere with the product at this point, and give serious trouble in the succeeding operations.

INTERMEDIATE FRAME.

The intermediate roving frame is a duplicate of the slubbing frame, excepting it has the addition of a creel for receiving the bobbins of roving from the preceding machine and which are doubled two into one, and drawn down by the rolls to a finer strand, twisted and wound onto bobbins for the next process.

The size of frames is smaller in proportion to hank roving required, but the same care and attention should be given the rolls, twist and tension as suggested for the slubber, and the draft should be comparatively short; the rolls on this frame handle the cotton in less bulk, but at the same time in drawing the sliver they have the twist to overcome; hard twisted roving cannot be drawn evenly, and very often rolls are spread farther apart to overcome excessive twist in slubber roving, which the length of staple does not warrant, with the result, that uneven roving is made, extra twist is put in and more trouble caused for the next process.

Vibration in the back and middle rolls should be carefully guarded against, and the causes are dry roll stands and frame being out of line or level. Wooden saddles should be replaced by iron wherever used, as they retard the free turning of the top rolls, particularly when they get worn.

FLY FRAME.

The fly frame is the last process in the carding room, unless the fourth or jack frame is used to double and draw the roving finer, in order to reduce the draft to a minimum on the spinning frame or mule for fine yarns.

The fly frame is a copy of the intermediate, excepting in the arrangement of the rolls and size of its different parts which are much smaller; the rolls have two ends to a boss or four to the roll.

The same general rules apply to the care of these as in the preceding frames, although the rolls require special attention, owing to the extra ends and fineness of roving. Much imperfect work is caused by a short traverse on this frame, for unless the holes in roving guide are close enough to allow a long traverse without running out at ends, and to over lap each other in the center of boss, it will leave a high place in the middle and a hollow roll will be the result, consequently there will be much uneven roving made, as the slivers cannot be held firmly by top roll. Very few traverse motions run quickly enough and nearly all allow more or less dwell at the ends. Traverse motions should be governed by the lifting rail, instead of by back roll and by a better arrangement more readily adjusted, another strong point would be that as lay shortened on the bobbin the length of traverse would change correspondingly. This is only a suggestion, however. Long or short draft affects the speed of traverse by the present method, and as draft of fly frames varies from 6 to 7½, it can readily be seen how the different drafts alter the time to traverse each way.

Extreme care should be taken to have rolls very true and evenly matched for front, and the bosses of the back rolls should be even in size.

Sheep skin makes a good covering for all back rolls and calf skin for front rolls, a roll covered with the latter can be buffed true without injury to the leather.

Vibration of the back rolls should be avoided and they should be inspected often, as this is a serious fault, and one which is more likely to occur on this frame, owing to the slower speed of back rolls and the greater number of ends to be drawn.

Very few mills are entirely free from this trouble, and it is the cause of many broken threads on the spinning and uneven and weak places in the yarn.

The tension should be carefully regulated, although a tight tension on this process does not injure the roving as on the slubber or intermediate, owing to its lighter weight and extra twist, but is more liable to break and cause a piecing.

If an end on a frame breaks by fault of tension being too tight, it breaks at presser, if tension is too slack, it will fly out of flyer on all processes of roving frames.

SPINNING FRAME.

It is not necessary in the spinning of an even thread to refer to spindles, bands and setting of spindles or rings except possibly in a general way; it is understood, however, that good, even, strong yarn can not be produced unless the roving has been prepared for it in the card room with that end in view, and if this has been accomplished, the result will be product and quality which will show its effect in the succeeding operations through which the yarn passes to the woven cloth. And on the strength of the warp yarn particularly, depends to a great extent the success of the mill, and the variation in strength and quality of yarn is more noticeable in those mills which manufacture sheetings or cloths that require strength in the warp, to withstand the strain on the yarn in the looms.

Coarse yarns up to and including No. 26 can be spun from single roving, and it will be strong enough owing to the size of thread, but finer yarns must be stronger in proportion and the only method is by spinning the yarn from double roving, not with an extreme draft, however, although the double roving will allow for a longer draft, which would not be possible with a single roving.

Double roving usually gives 10 per cent. stronger yarn, and a smoother and evener thread.

There are various opinions as to the advantage between the short and long boss roll; on medium and fine numbers, the advantage seems to be on the side of the latter roll for several reasons, to wit: less saddles to be kept in place and leavers adjusted; less oiling consequently less liability for oil to get on the yarn; less cleaning by half as many rolls and ends to keep clean and free from waste, and if spinning fine yarns, less trouble will be experienced if weight is taken off middle rolls, for owing to the long roll being heavier, it does not retard the delivery of

roving to front roll, and it is not necessary to spread the rolls for the long staple as with frames equipped with short boss rolls; this is a decided advantage.

The solid front top roll seems to be preferred by many and for medium or fine work, is preferable. Rolls should be evenly covered with light lamb skin, and cot should not be drawn on too tight, and prevent the cushion action on steel roll owing to their small diameter.

If front top rolls are shell, they should be carefully matched in pairs before putting on an arbor by testing in a gauge for the purpose; solid rolls ought to be tested also for variation in size; a good roll coverer will have no trouble in matching his cots, if he gives the matter careful attention. Short boss rolls do not require the care in covering that is necessary in the long roll.

Spindles, rings and thread guides must be set and adjusted properly to get the best results, and as it is the small matters which make up the whole in spinning, the little details should receive careful attention in order to get the product per spindle which determines the ability of the successful spinner, and spindles should be run at their highest speed, commensurate with good work and their greatest efficiency.

SPOOLING.

The spooling frame is one of the simplest and most easily operated machines in a cotton mill and winds the yarn from the warp bobbins on to the spool, and in doing this, special care should be taken that bobbin holders are set the proper angle so as to get the least possible strain on the yarn, also that holders are the correct size to receive the bobbins of same, and that holder wires are not too heavy for the numbers of yarn being spooled. The thread guides should be set close enough to prevent a bunch or loose waste passing through same onto spool; a too quick traverse is also an objection, and a happy medium between the half and full spool is desirable in order to get a hard, firm and even spool of yarn; the quick traverse crosses over the threads in-

stead of laying them parallel to each other, and by the unwinding of yarn from spool at the warper creel on the slow traverse, there will be noticed less snap and pull, as yarn reverses on each wind.

It would be an advantage, if spooling frames were arranged so that the speed of traverse could be as easily changed as on a spinning frame.

While the spooling operation has always been a simple matter, its effect has always been serious, owing to the neccessity of a knot on the emptying of the warp bobbin, and several being necessary to fill spool, although the increased size of ring and traverse on the spinning, has allowed a correspondingly greater amount of yarn to be wound onto bobbins and has lessened the knots which have always been a handicap to getting the best results on the weaving, the disadvantage, however, is in the irregular tying of knots by the operatives, as no two would tie exactly the same, and it is not possible for any person to break the threads the same length in tying the many hundreds each day, particularly as the spooler tender is always paid by the amount turned off, and they are very apt to let a poorly tied knot go, hoping that it will pass without being noticed at the warper, and if it gets to loom, a bad knot always breaks and causes more or less trouble.

The knotter placed on the market several years ago seems to have filled a long-felt want, as it ties the knots automatically, and cuts the threads so that all knots are uniform in length, and it is almost impossible to find a poor knot from the spooling, if machines are given attention and kept in good condition. The result of this is an increased production in weaving with less imperfections in cloth, which caunot be avoided by the old method of hand tied knots.

WARPING.

The warping of the yarn from spools to section beam is not a hard problem, although it requires a fair amount of skill in the operative to prepare the yarn for the slashers in the best

manner. If the yarn is strong and spooling has been done properly, everything will run smoothly at the warper, but if it is otherwise, a low product will result, with the usual difficulty in slashing with tie backs, spare threads and extra knots for the weaver to overcome in the warp.

Moderate speed is desirable in a warper owing to the number of threads usually wound onto beam, and the necessity for a quick stop for a broken thread, also a quick action of the drop wire mechanism for stopping machine must be realized, and it is very essential that same be carefully looked after so that they will drop easily and quickly, and it will prevent many lost threads which cannot be picked up after drum has made several revolutions.

Smooth section beams with yarn wound on evenly, and the belt kept on the tight pulley from warp to warp, assures good work at the slasher which is necessary, as the stopping and starting of a slasher in the middle of a warp caused by poor warping, does not improve its weaving qualities.

SLASHING.

To the sizing of the warp threads depends the success in the final process of manufacturing, for without the proper coating of size on the yarn, no matter what its strength in the single thread, it could not withstand the chafing of the harnesses and reed, and the higher the counts more care must be exercised in its preparation for the loom. It is not necessary to go into details as to the merits of the various compounds used in size, with either corn, or potato starch for the foundation.

Every one is fully aware that all size must be thoroughly cooked, and of the right consistency for the style of cloth and number of yarn to be dressed, and to a great extent the details are left in the hands of the slasher tender.

The temperature of the size should be kept uniform to get the best results, and the only way is to have the prepared size that enters size box from kettle, of even temperature, with result that less steam will be needed to keep size in condition required, and it will not vary by excess amount of water entering same.

The best method to accomplish this seems to be the arrangement of the return pipe in connection with feed, forced to and back by the rotary pump system, this keeps up a circulation of the size, and if not drawn off into size box is returned to kettle, it also keeps the size thoroughly mixed and of even quality.

Which is the best, exhaust or live steam for drying the yarn?

Exhaust steam may be used successfully on light sley goods, but it is doubtful if it could be used on what is termed sheetings, and have the yarn dried sufficiently. Slashers should be situated as near to the boilers as possible in order to reduce the condensation to a minimum, whether for kettle, size box or cylinders.

There is no set rule governing the product of a slasher, as the conditions are never the same under which they are run, but great care should be taken not to unnecessarily stretch the yarn while wet, for undue strain on the yarn in dressing, eliminates the natural stretch in the threads which is requisite for good weaving.

Extreme care should also be taken to have cylinders properly trapped, for while water in a cylinder prevents its drying the yarn, it also is a serious objection owing to its extra weight which adds to the strain on same.

FILLING.

Whether the filling is spun on frame or mule the thread should be as even and strong in proportion to its number and twist as the warp, for to the evenness and quality of the filling if loom is adjusted properly, largely depends the appearance of the cloth. To accomplish this it is necessary that the same stock be used as in the warp, and not separate the poorer grade of cottons for the filling, for in doing this the above yarn would necessarily be of an inferior quality which would show its effect in the appearance of the finished fabric. An extreme draft is not desirable in the spinning of filling yarns either on a frame or mule, although yarn from the latter machines is usually spun from coarser roving than would be possible on a filling frame,

and it would seem preferable to spin same from roving with a medium draft, or, from double roving, and particularly so for fine sheetings, cambrics and other styles of cloth, that require finer filling than the warp and which have a higher count or pick, than sley.

As good filling spinning is absolutely necessary in order to get the maximum product from the looms, which is always desired, and as the above determines this matter to some extent, extra care should be taken to get this result, for the increased cost of a finer hank roving if this is accomplished, is a small matter if an improved quality of filling is secured, and a high standard should be maintained, as poor filling is as serious a draw back to success in the weaving as poor warp yarn, and is the cause of fully as much trouble in this department of a mill.

Smooth, even filling yarn gives character to any fabric, at the same time improving its finishing qualities, and increases their value owing to the better appearance of the finished goods.

The PRESIDENT. Gentlemen, while I believe it is no part of the privileges of the President of this Association to discuss any paper I trust I may be permitted to say that I agree with almost everything that Mr. WILLEY has said. I think it would be a very good thing if every overseer and every superintendent in every mill in this country could have a copy of that paper and read it and digest it and put into practice almost every suggestion he has made.

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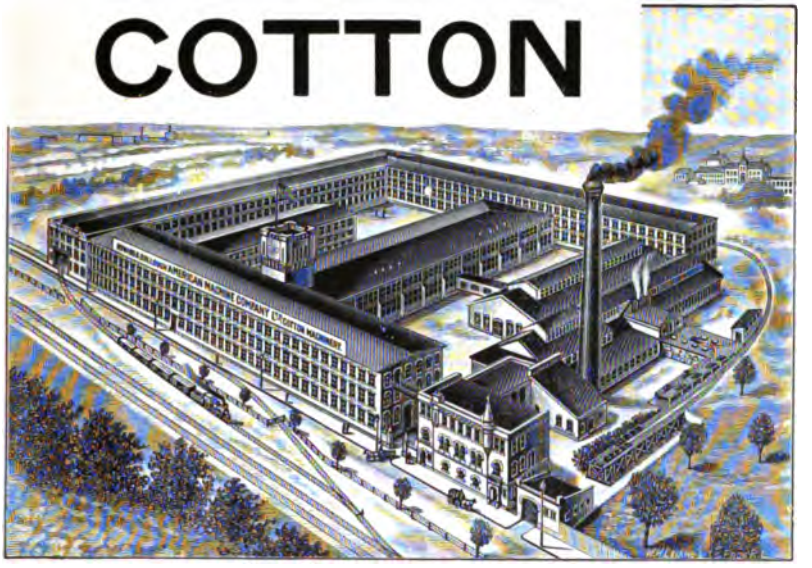

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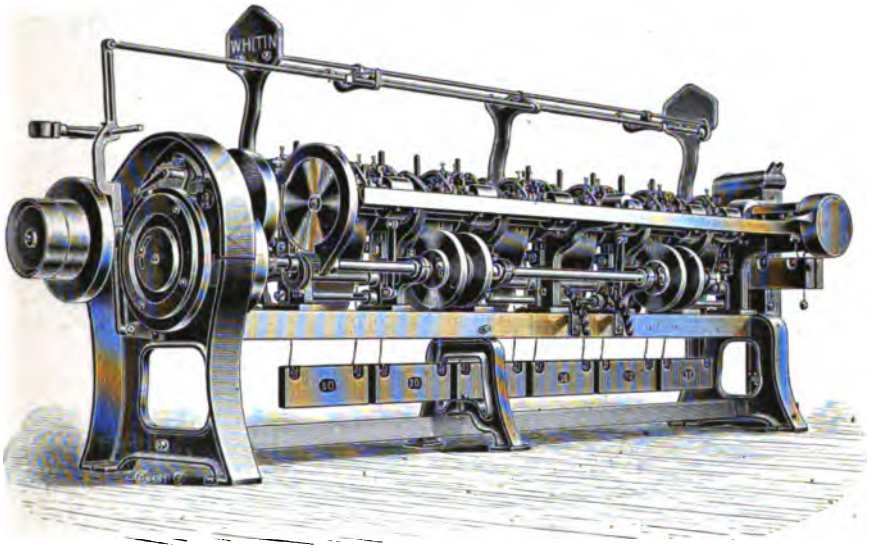

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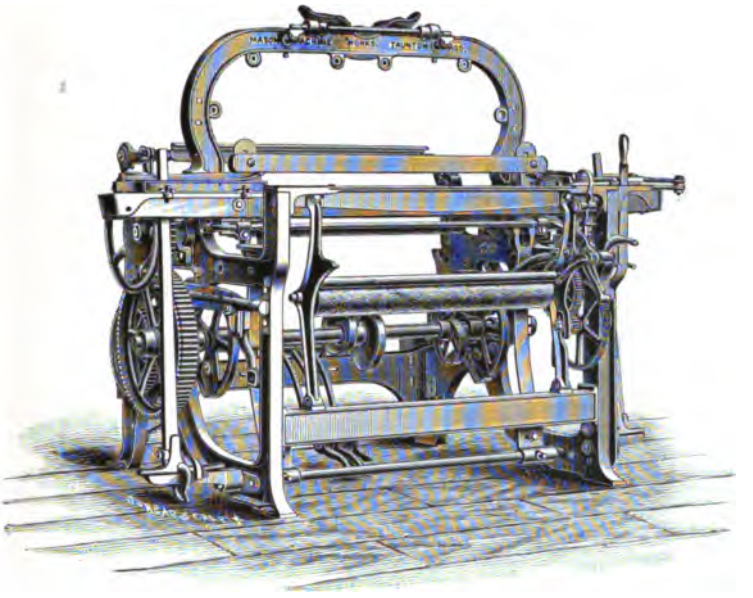

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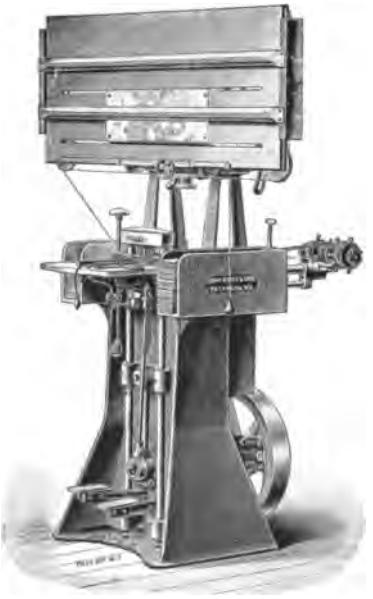

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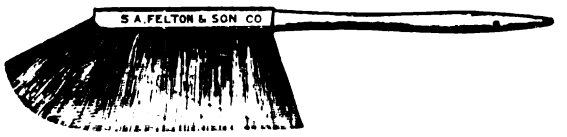

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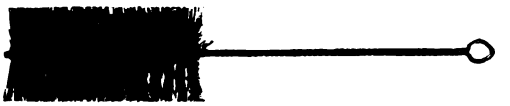

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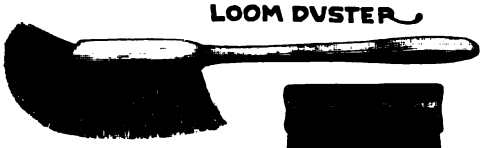

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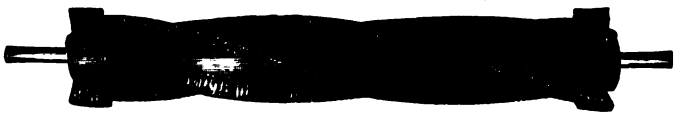

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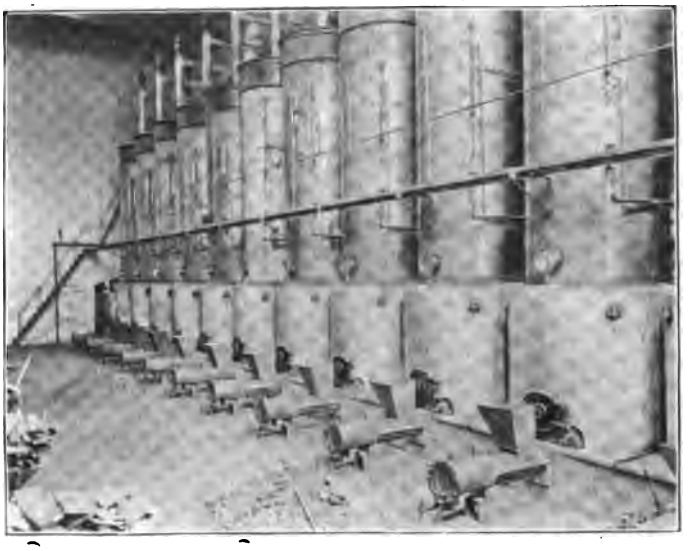

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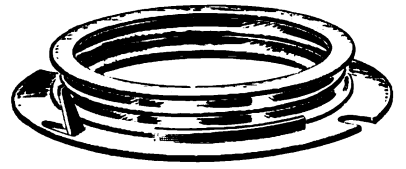

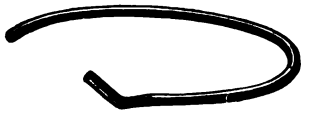

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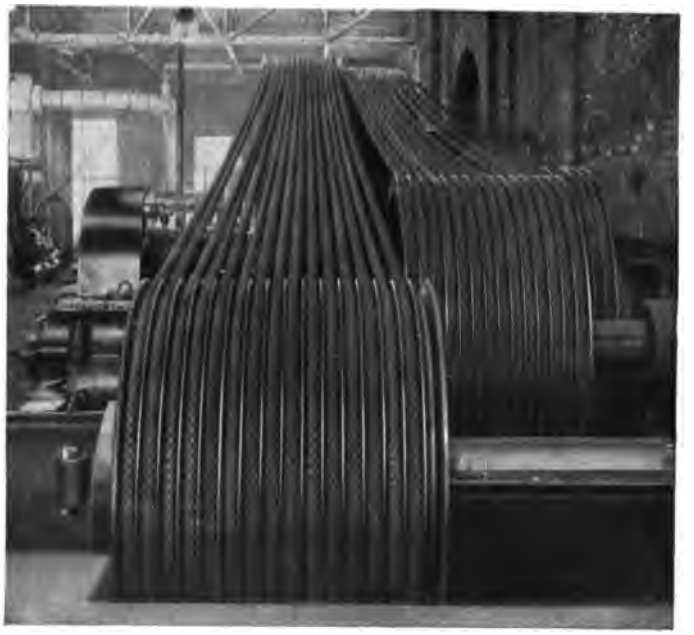

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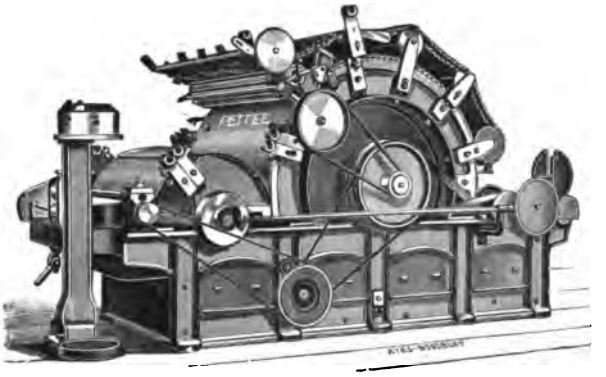

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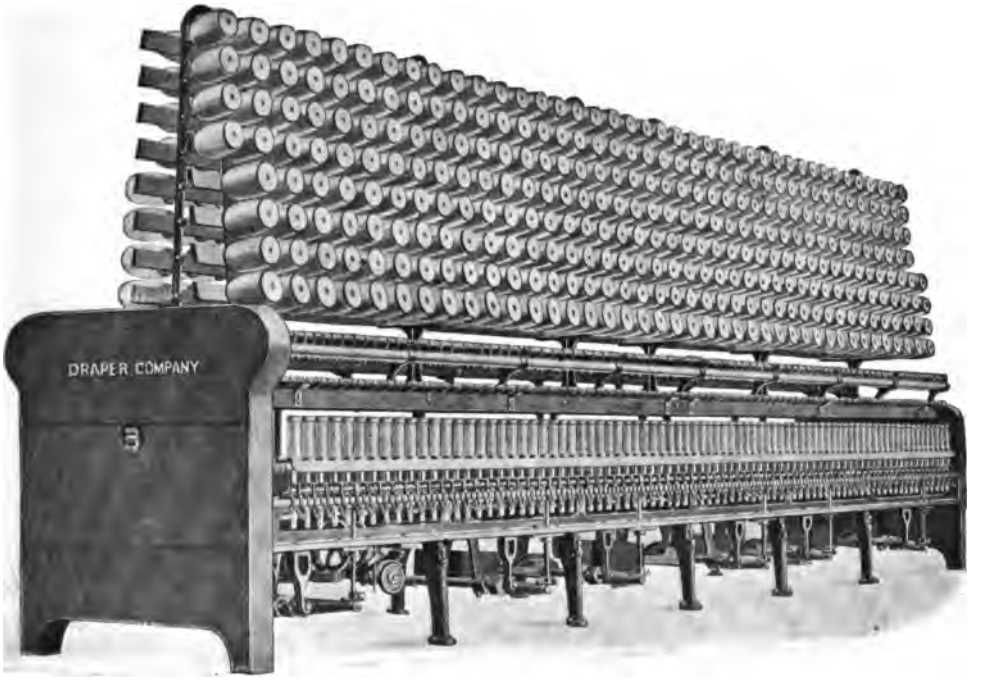

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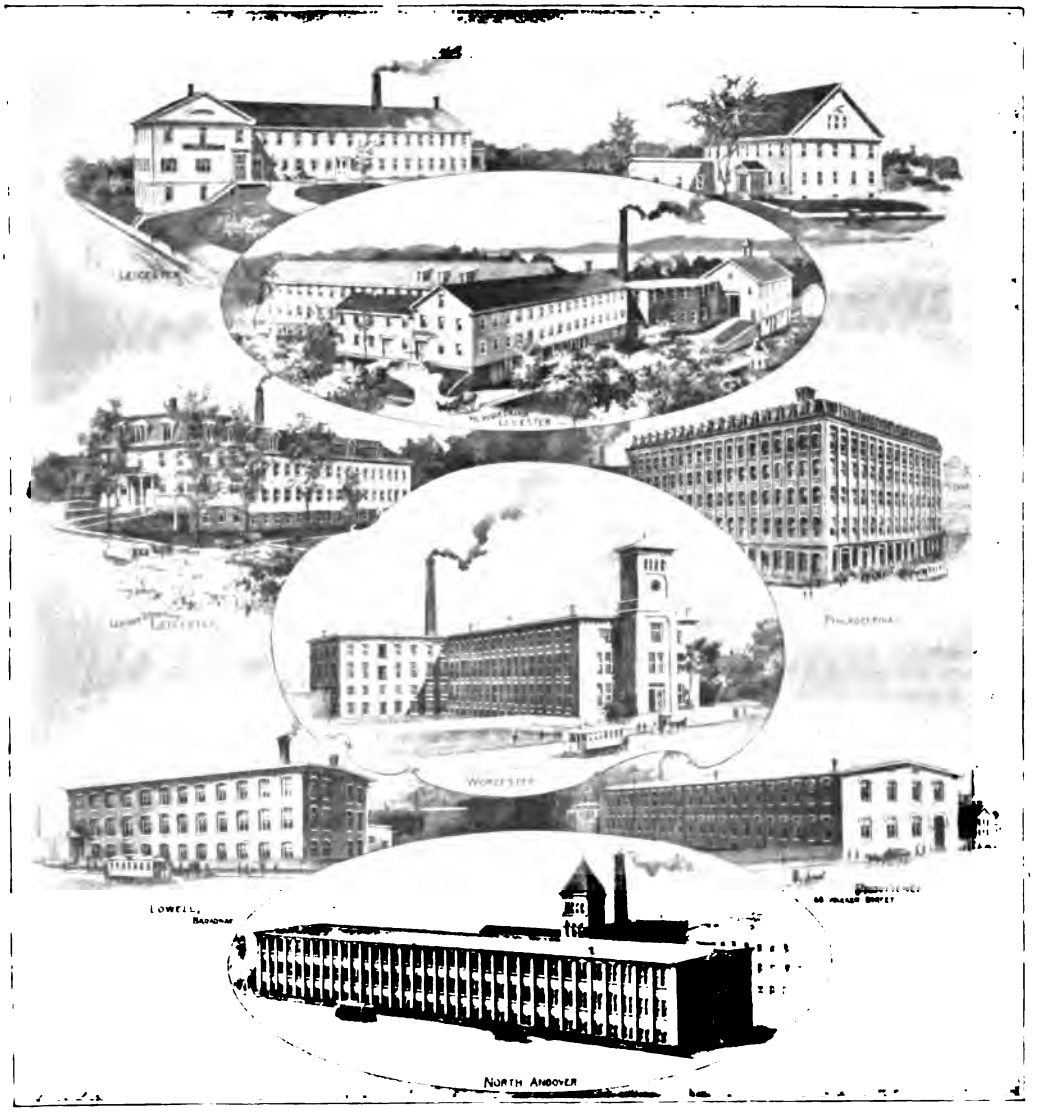

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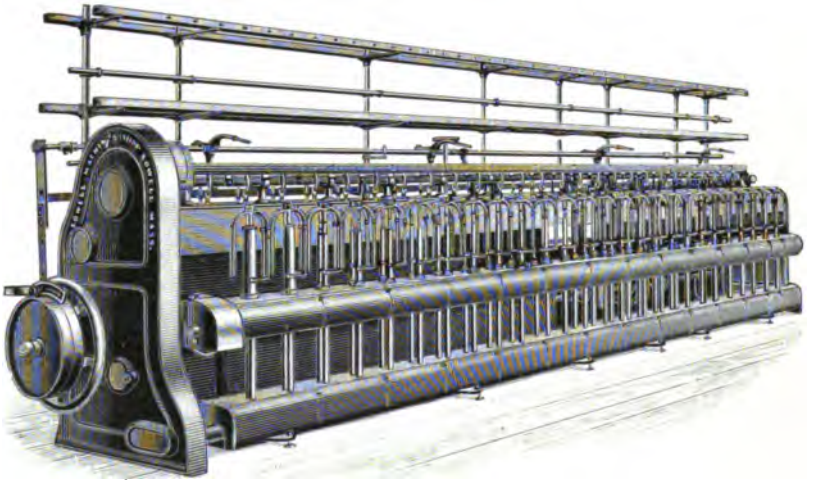

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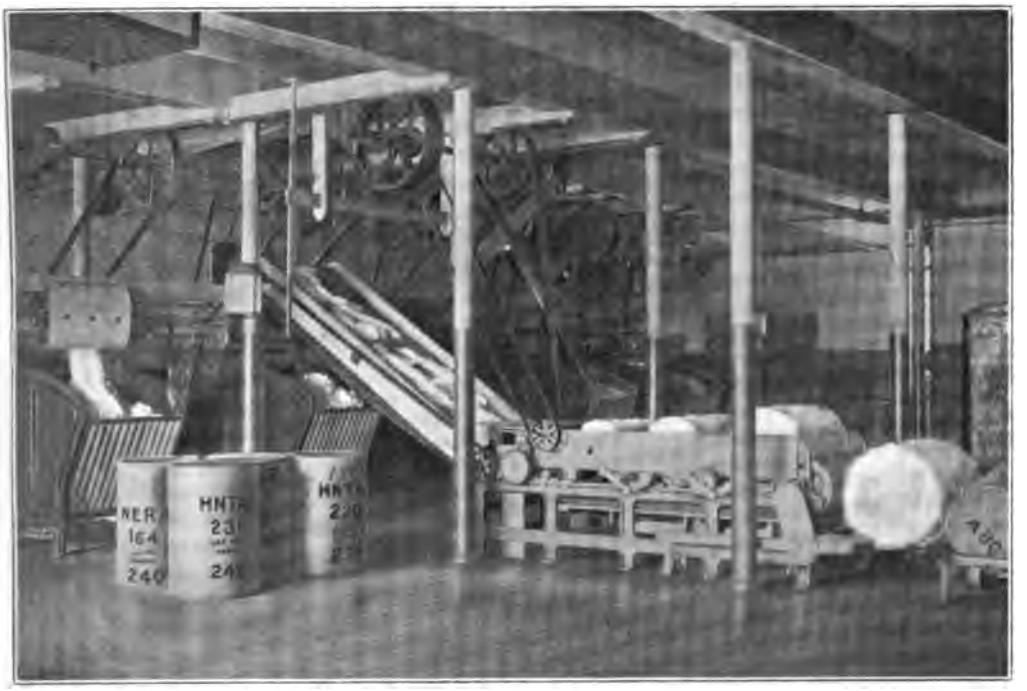

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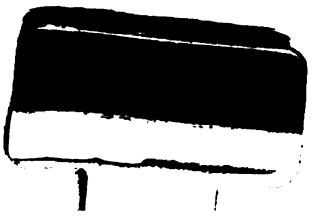
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